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Volume 2. Direct Coal Liquefaction Products

TRW Energy Systems Group, Redondo Beach, CA

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A COMPENDIUM OF REPORTED PHYSICAL AND CHEMICAL CHARACTERIZATION DATA FOR PETROLEUM AND SYNTHETIC FUEL PRODUCTS

Volume II - Direct Coal Liquefaction Products

by

S. Quinlivan, A. Panahloo,
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OFFICE OF PESTICIDES AND TOXIC SUBSTANCES
U.S. ENVIRONMENTAL PROTECTION AGENCY
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16. Abstract (Limit: 200 words)

This compendium consolidates a large quantity of diverse data which have been generated and reported by numerous investigators over the past several decades. The products for which data have been compiled are: crude petroleum, raw and hydrotreated shale oil, raw and hydrotreated whole coal liquids and intermediates, and petroleum-, coal-, and shale-derived naphtha, jet and diesel fuels and other light fuel oils, heavy fuel oils, and residua. Coal liquids addressed are those from H-Coal, EDS, SRC-I and SRC-II direct coal liquefaction processes. Sixty-six individual properties relating to the following six characterization categories are covered: general physical and chemical properties, elemental composition data, hydrocarbon compound class properties, nitrogen-, oxygen-, and sulfur-containing compounds/compound class properties, properties of various distillation fractions, and properties of "non-primary" products and their distillation fractions.

Primarily, this effort has consisted of assembling data and has not included evaluation of data quality or the development of conclusions as to similarities and differences between a synfuel and its analogous petroleum product. Limitations of the data base are noted.

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CONTENTS

VOLUME I. Petroleum and Shale Oil Products

Abstract iii

Acknowledgements v

1.0 Background, Objectives, Scope, and Overview of the Current Data Base 1

2.0 Data Sources and Organization of the Compendium 4

3.0 Glossary. 24

3.1 Sample Sources/Descriptions. 24
3.2 Abbreviations and Symbols. 26

Part I. Petroleum Crude, Raw Shale Oil, and Hydrotreated Shale Oil 27

Part II. Naphtha. 118

Part III. Jet Fuel. 144

Part IV. Diesel Fuel. 191

Part V. Residual Fuel 235

VOLUME II. Direct Coal Liquefaction Products

Part VI. Raw and Hydrotreated Whole Process Liquids 267

Part VII. Coal Liquid Intermediates 328

Part VIII. Naphthas 450

Part IX. Raw and Hydrotreated Middle Distillates and Blends (Jet, Diesel, Other Light Fuel Oils). 597

Part X. Raw and Hydrotreated Heavy Distillates (Heavy Fuel Oils) and Residua 719

References 896

Part VI. Raw and Hydrotreated Whole Process Liquids

Table 163. Specific Gravity

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	0.9427	Ft. Lewis pilot plant	144
	EDS	IL No. 6 (Monterey Mine)	0.928	One tpd pilot plant, once-through mode	144
Hydrotreated whole process liquids	NA	--	--	--	--

Table 164. API Gravity

Material	Process	Coal Type	Value (degrees)	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	KY No. 9 and 14 IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	18.6	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	86
	EDS	IL No. 6 (Monterey Mine)	21.0	One tpd pilot plant, once-through mode	144
	H-Coal	Wyodak	35.1	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	25.8	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95
		IL No. 6	20.9	PDU, syncrude mode	98
		IL No. 6 (Burning Star Mine)	27.6	PDU, Ashland Oil sample	96
		Wyodak	36.0	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 7064)	95
		IL No. 6	28.2	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 6979)	95
Hydrotreated whole process liquids	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	37.1	From high severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.0; total pressure, 2500 psig; H_2 mean pressure, 2325 psia; recycle gas, 14,550 SCF/bbl)	141

(Continued)

Table 164 (Concluded)

Material	Process	Coal Type	Value (degrees)	Sample Description/Source	Reference
Hydrotreated whole process liquids	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	34.3	From intermediate severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature 750°F; LHSV, 1.5; total pressure, 2500 psig; H_2 mean pressure, 2345 psia; recycle gas, 14,830 SCF/bbl)	141
		Pitt-Seams WV (Blackville No. 2 Mine)	30.3	From low severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2000 psig; H_2 mean pressure, 1765 psia; recycle gas, 8070 SCF/bbl)	141

Table 165. Density

Material	Process	Coal Type	Value (g/ml)	Sample Description/Source	Reference
Coal raw whole process liquids	H-coal	Wyodak	1.204 (70°F)	PDU Run 10 (ORNL Sample 27B)	158
		Wyodak	1.238 (70°F)	PDU Run 10 (ORNL Sample 34A)	158
		Wyodak	1.201 (70°F)	PDU Run 10 (ORNL Sample 42A)	158
		Wyodak	1.171 (70°F)	PDU Run 10 (ORNL Sample 43A)	158
		Wyodak	0.8405 (68°F)	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 7064)	95
		IL No. 6	0.8626 (68°F)	PDU, syncrude mode, rerun whole process liquid, (Chevron Sample No. SGQ 6979)	95
Hydro-treated whole process liquids	NA	--	--	--	--

Table 166. Distillation Data

Material	Process	Coal Type	Value % (Degrees)	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	KY No. 9 and 14 IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	154/217°F-IBP/5* 281/382°F-10/30 438°F-50 484/597°F-70/90 699/850°F-95/EP	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	86
	H-Coal	Wyodak	120/188°F-IBP/5* 215/280°F-10/30 355°F-50 424/526°F-70/90 601/650°F-95/EP	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	140/204°F-IBP/5* 236/329°F-10/30 398°F-50 466/582°F-70/90 648/704°F-95/EP	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95

(Continued)

Table 166 (Concluded)

Material	Process	Coal Type	Value (Degrees)	Sample Description/Source	Reference
Hydrotreated whole process liquids	NA	--	--	--	--

Explanatory Notes

*Determined via ASTM D-86 and/or D-1160.

Table 167. GC Simulated Distillation

Material	Process	Coal Type	Value (Boiling Point Range	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	56/189°F-IBP/5 241/579°F-10/30 424°F-50 473/562°F-70/90 642/820°F-95/99	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	86
	H-Coal	Wyodak	53/156°F-IBP/5 173/261°F 10/30 354°F-50 429/535°F-70/90 602/785°F-95/99	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	56/177°F-IBP/5 213/333°F-10/30 404°F-50 476/588°F-70/90 654/765°F 95/99	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95

(Continued)

Table 167 (Continued)

Material	Process	Coal Type	Value (Boiling Point Range)	Sample Description/Source	Reference
Coal raw whole process liquids	H-Coal	Wyodak	52/165-IBP/5 178/269-10/30 356-50 424/509-70/90 542/603-95/99	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 7064)	95
		IL No. 6	101/175-IBP/5 181/194-10/30 335-50 417/508-70/90 538/589-95/99	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 6979)	95
Hydrotreated whole process liquids	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	62/177°F-IBP/5 210/278°F-10/30 364°F-50 419/505°F-70/90 553/662°F-95/99	From high severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.0; total pressure, 2500 psig; H_2 mean pressure, 2325 psia; recycle gas, 14,550 SCF/bbl)	141
		Pitt-Seams WV (Blackville No. 2 Mine)	59/176°F-IBP/5 210/279°F-10/30 370°F-50 436/519°F-70/90 572/690°F-95/99	From intermediate severity hydrotreatment with ICR 106 catalyst, Chevron Sample (Operating conditions: average catalyst temperature, 750°F: LHSV, 1.5: total pressure, 2500 psig; H_2 mean pressure, 2345 psia; recycle gas, 14,830 SCF/bbl)	141

(Continued)

Table 167 (Concluded)

Material	Process	Coal Type	Value (Boiling Point Range)	Sample Description/Source	Reference
Hydrotreated whole process liquids	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	58/174°F-IBP/5 212/292°F-10/30 394°F-50 446/539°F-70/90 600/728°F-95/99	From low severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2000 psig; H_2 mean pressure, 1765 psia; recycle gas, 8070 SCF/bbl)	141

Table 168. Refractive Index

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	1.5073 (176°F)	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	86
	H-Coal	Wyodak	1.4735 (68°F)	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	1.5050 (68°F)	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95
Hydro-treated whole process liquids	NA	--	--	--	--

Table 169. Molecular Weight

Material	Process	Coal Type	Value (g/mole)	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	132	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	86
	H-Coal	Wyodak	130	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	147	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95
		Wyodak	136	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 7064)	95
		IL No. 6	136	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 6979)	95
Hydrotreated whole process liquids	NA	--	--	--	--

Table 170. Viscosity

Material	Process	Coal Type	Value (Centi-Stokes)	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seam WV (Blackville No. 2 Mine)	2.196 (100°F) 1.617 (130°F)	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	86
	H-Coal	Wyodak	1.225 (100°F)	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	1.645 (100°F)	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95
Hydro-treated whole process liquids	NA	--	--	--	--

Table 171. Pour Point

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	<-80	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	86
Hydrotreated whole process liquids	NA	--	--	--	--

Table 172. Carbon Residue*

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	0.70	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	86
	H-Coal	Wyodak	0.23	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	0.29/ 0.30	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95
		Wyodak	0.15	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 7064)	95
		IL No. 6	0.30	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 6979)	95
Hydrotreated whole process liquids	NA	--	--	--	--

Explanatory Notes

*Ramsbottom carbon residues

Table 173. Heat of Combustion

Material	Process	Coal Type	Value (Btu/lb)	Sample Description/Source	Reference
Coal raw whole process liquids	EDS	IL No. 6 (Monterey Mine)	18,710 (HHV)	One tpd pilot plant, once-through mode	144
Hydrotreated whole process liquids	NA	--	--	--	--

Table 174. Aniline Point

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	<30	Ft.Lewis pilot plant (Chevron Sample No. WOW-3666)	86
	H-Coal	IL No. 6	<32	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95
Hydrotreated whole process liquids	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	98.7	From high severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.0; total pressure, 2500 psig; H_2 mean pressure, 2325 psia; recycle gas, 14,550 SCF/bbl)	141
		Pitt-Seams WV (Blackville No. 2 Mine)	69.9	From intermediate severity hydrotreatment with ICR 106 catalyst, Chevron Sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2500 psig; H_2 mean pressure, 2345 psia; recycle gas, 14,830 SCF/bbl)	141

(Continued)

Table 174 (Concluded)

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Hydrotreated whole process liquids	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	38.3	From low severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2000 psig; H_2 mean pressure, 1765 psia; recycle gas, 8070 SCF/bbl)	141

Table 175. Bromine Number

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	70	Ft. Lewis pilot plant (Chevron Sample No WOW-3666)	86
	H-Coal	Wyodak	24/27	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	37/40	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95
		Wyodak	17	PDU, syncrude mode, re-run whole process liquid (Chevron Sample No. SGQ 7064)	95
		IL No. 6	31	PDU, syncrude mode, re-run whole process liquid (Chevron Sample No. SGQ 6979)	95
Hydro-treated whole process liquids	NA	--	--	--	--

Table 176. Oxygen Content

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	3.79	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	86
		Pitt-Seams WV (Blackville No. 2 Mine)	3.79	Ft. Lewis pilot plant	144
	EDS	IL No. 6 (Monterey Mine)	1.75	One tpd pilot plant, once-through mode	144
	H-Coal	Wyodak	0.85	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	1.88/ 1.71	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95
		Wyodak	0.67	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 7064)	95
		IL No. 6	1.96	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 6979)	95
		IL No. 6 (Burning Star Mine)	1.93	PDU, Ashland Oil sample	96

(Continued)

Table 176 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	Wyodak	2.5*	PDU Run 10 (ORNL Sample 27B)	146
		Wyodak	1.4*	PDU Run 10 (ORNL Sample 34A)	146
		Wyodak	1.5*	PDU Run 10 (ORNL Sample 42A)	146
		Wyodak	1.6*	PDU Run 10 (ORNL Sample 43A)	146
		NA	4.66 (Batch 1)† 4.11 (Batch 2) 4.12 (Batch 3) 4.80 (Batch 6)	PDU Run 130-73	145
Hydrotreated whole process liquids		Pitt-Seams WV (Blackville No. 2 Mine)	0.0070‡	From high severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.0; total pressure, 2500 psig; H_2 mean pressure, 2325 psia; recycle gas, 14,550 SCF/bbl)	141
		Pitt-Seams WV (Blackville No. 2 Mine)	0.0550‡	From intermediate severity hydrotreatment with ICR 106 catalyst, Chevron Sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2500 psig; H_2 mean pressure, 2345 psia; recycle gas, 14,830 SCF/bbl)	141

(Continued)

Table 176 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated whole process liquids	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	0.4300‡	From low severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2000 psig; H_2 mean pressure, 1765 psia; recycle gas, 8670 SCF/bbl)	141

Explanatory Notes

*By difference

†Batches 4 and 5 were blended with same proportions of atmospheric overhead, atmospheric bottom and de-ashed vacuum bottoms as Batch 3. They were not analyzed.

‡Includes dissolved water.

Table 177. Sulfur Content

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	0.29	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	86
		Pitt-Seams WV (Blackville No. 2 Mine)	0.29	Ft. Lewis pilot plant	144
	EDS	IL No. 6 (Monterey Mine)	0.479	One tpd pilot plant, once-through mode	144
	H-Coal	Wyodak	0.041	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	0.31/ 0.33	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95
		Wyodak	0.025	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 7064)	95
		IL No. 6	0.14	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 6979)	95
		IL No. 6	0.22	PDU, syncrude mode	98

(Continued)

Table 177 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw whole process liquids	H-Coal	IL No. 6 (Burning Star Mine)	0.47	PDU, Ashland Oil sample	96
		Wyodak	0.3	PDU Run 10 (ORNL Sample 27B)	146
		Wyodak	0.4	PDU Run 10 (ORNL Sample 34A)	146
		Wyodak	0.5	PDU Run 10 (ORNL Sample 42A)	146
		Wyodak	0.4	PDU Run 10 (ORNL Sample 43A)	146
		NA	0.70 (Batch 1)* 0.62 (Batch 2) 0.57 (Batch 3) NA (Batch 6)	PDU Run 130-73	145
Hydrotreated whole process liquids	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	0.00041	From high severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.0; total pressure, 2500 psig; H_2 mean pressure, 2325 psia; recycle gas, 14,550 SCF/bbl)	141
		Pitt-Seams WV (Blackville No. 2 Mine)	0.00046	From intermediate severity hydrotreatment with ICR 106 catalyst, Chevron Sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2500 psig; H_2 mean pressure, 2345 psia; recycle gas, 14,830 SCF/bbl)	141

(Continued)

Table 177 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated whole process liquids	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	0.0010	From low severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2000 psig; H_2 mean pressure, 1765 psia; recycle gas, 8070 SCF/bbl)	141

Explanatory Notes

*Batches 4 and 5 were blended with same proportions of atmospheric overhead, atmospheric bottom and de-ashed vacuum bottoms as Batch 3. They were not analyzed.

Table 178. Nitrogen Content

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	0.85	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	86
		Pitt-Seams WV (Blackville No. 2 Mine)	0.85	Ft. Lewis pilot plant	144
	EDS	IL No. 6 (Monterey Mine)	0.48	One tpd pilot plant, once-through mode	144
	H-Coal	Wyodak	0.17	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	0.44/ 0.48	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95
		Wyodak	0.15	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 7064)	95
		IL No. 6	0.33	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 6979)	95
		IL No. 6 (Burning Star Mine)	0.81	PDU, Ashland Oil sample	96

(Continued)

Table 178 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw whole process liquids	H-Coal	Wyodak	0.7	PDU Run 10 (ORNL Sample 27B)	146
		Wyodak	0.8	PDU Run 10 (ORNL Sample 34A)	146
		Wyodak	0.8	PDU Run 10 (ORNL Sample 42A)	146
		Wyodak	0.7	PDU Run 10 (ORNL Sample 43A)	146
		NA	(Batch 1)* (Batch 2) (Batch 3) (Batch 6)		145
Hydro-treated whole process liquids	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	0.000045	From high severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.0; total pressure, 2500 psig; H_2 mean pressure, 2325 psia; recycle gas, 14,550 SCF/bbl)	141
		Pitt-Seams WV (Blackville No. 2 Mine)	0.0021	From intermediate severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2500 psig; H_2 mean pressure, 2345 psia; recycle gas, 14,830 SCF/bbl)	141

(Continued)

Table 178 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated whole process liquids	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	0.0513	From low severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2000 psig; H_2 mean pressure, 1765 psia; recycle gas, 8070 SCF/bbl)	141

Explanatory Notes

*Batches 4 and 5 were blended with same proportions of atmospheric overhead, atmospheric bottom and de-ashed vacuum bottoms as Batch 3. They were not analyzed.

Table 179. Carbon Content

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	84.68	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	86
		Pitt-Seam, WV (Blackville No. 2 Mine)	84.61	Ft. Lewis pilot plant	144
	H-Coal	Wyodak	86.20	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	86.94	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95
		IL No. 6	86.13	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 6979)	95
		IL No. 6 (Burning Star Mine)	87.6	PDU, Ashland Oil sample	96
		Wyodak	77.9	PDU Run 10 (ORNL Sample 27B)	146
		Wyodak	78.7	PDU Run 10 (ORNL Sample 34A)	146
		Wyodak	78.4	PDU Run 10 (ORNL Sample 42A)	146

(Continued)

Table 179 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw whole process liquids	H-Coal	Wyodak	80.3	PDU Run 10 (ORNL Sample 43A)	146
		NA	(Batch 1)* (Batch 2) (Batch 3) (Batch 6)	PDU Run 130-73	145

Explanatory Notes

*Batches 4 and 5 were blended with same proportions of atmospheric overhead, atmospheric bottom and de-ashed vacuum bottoms as Batch 3. They were not analyzed.

Table 180. Hydrogen Content

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	10.54	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	86
		Pitt-Seams WV (Blackville No. 2 Mine)	10.46	Ft. Lewis pilot plant	144
	EDS	IL No. 6 (Monterey Mine)	10.56	One tpd pilot plant, once-through mode	144
	H-Coal	Wyodak	12.74	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	11.39	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95
		IL No. 6	11.44	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 6979)	95
		IL No. 6 (Burning Star Mine)	7.4	PDU, Ashland Oil sample	96
		Wyodak	6.3	PDU Run 10 (ORNL Sample 27B)	146
		Wyodak	6.2	PDU Run 10 (ORNL Sample 34A)	146

(Continued)

Table 180 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw whole process liquids	H-Coal	Wyodak	6.7	PDU Run 10 (ORNL Sample 42A)	146
		Wyodak	7.2	PDU Run 10 (ORNL Sample 43A)	146
		NA	6.71 (Batch 1)* 7.15 (Batch 2) 7.30 (Batch 3) 7.38 (Batch 6)	PDU Run 130-73	145
Hydrotreated whole process liquids	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	12.8	From high severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.0; total pressure, 2500 psig; H_2 mean pressure, 2325 psia; recycle gas, 14,550 SCF/bbl)	141
		Pitt-Seams WV (Blackville No. 2 Mine)	12.1	From intermediate severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2500 psig; H_2 mean pressure, 2345 psia; recycle gas, 14,830 SCF/bbl)	141

(Continued)

Table 180 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated whole process liquids	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	11.4	From low severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2000 psig; H_2 mean pressure, 1765 psia; recycle gas, 8070 SCF/bbl)	141

Explanatory Notes

*Batches 4 and 5 were blended with same proportions of atmospheric overhead, atmospheric bottom and de-ashed vacuum bottoms as Batch 3. They were not analyzed.

Table 181. Trace Element Content (ppmw)

Material	Process	Coal Type	Ti	V	Ca	Mg	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	Pittsburgh (Powhattan No. 5 Mine)	1.4	<0.01	98	<6	Ft. Lewis pilot plant	140
			Al	Cl	Mn	As		
			<0.5	0.538	0.010	0.064		
			Sb	Se	Hg	Br		
			0.00185	0.064	0.057	0.00918		
			Ni	Co	Cr	Fe		
			0.034	0.00135	0.021	2.43		
			Na	Rb	Cs	K		
			0.095	<0.007	0.00047	0.22		
			Sc	Tb	Eu	Sm		
			0.00023	<0.00006	0.000078	0.000052		
			Ce	La	Sr	Ba		
			<0.004	0.00091	<0.12	0.082		
			Th	U	Hf	Ta		
			<0.0004	<0.0015	<0.0003	<0.0002		
			Ga	Zr	Cu	Zn		
			0.00031	ND	5.88	0.021		
Hydro-treated whole process liquids	NA	--			--		--	--

Table 182. Ash Content (by Ultimate Analysis)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	0.004	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	86
	H-Coal	Wyodak	<0.002	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	0.009	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95
		Wyodak	<0.003	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 7064)	95
		IL No. 6	<0.002	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 6979)	95
Hydrotreated whole process liquids	NA	--	--	--	--

Table 183. Saturates and Aromatics Content

Material	Process	Coal Type	Value (Vol %)	Sample Description/Source	Reference
Coal raw whole process liquids A. Saturates	SRC-II	NA	44.6	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	94
	H-Coal	Wyodak	56.1	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	44.6	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95
		Wyodak	47.2	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 7064)	95
		IL No. 6	45.7	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 6979)	95
Hydrotreated whole process liquids	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	82.2	From high severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.0; total pressure, 2500 psig; H_2 mean pressure, 2325 psia; recycle gas, 14,550 SCF/bbl)	141
		Pitt-Seams WV (Blackville No. 2 Mine)	65.8	From intermediate severity hydrotreatment with ICR 106 catalyst, Chevron Sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2500 psig; H_2 mean pressure, 2345 psia; recycle gas, 14,830 SCF/bbl)	141

(Continued)

Table 183 (Continued)

Material	Process	Coal Type	Value (Vol %)	Sample Description/Source	Reference
Hydrotreated whole process liquids	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	52.3	From low severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2000 psig; H_2 mean pressure, 1765 psia; recycle gas, 8070 SCF/bbl)	141
		NA	51.3	Ft. Lewis pilot plant, moderate severity hydrotreatment	128
		NA	96.5	Ft. Lewis pilot plant, high severity hydrotreatment	129
	H-Coal	Wyodak	88.5	PDU, from medium severity hydrotreatment	128
		IL No. 6	81.5	PDU, from high severity hydrotreatment	128
Coal raw whole process liquids B. Aromatics	SRC-II	NA	55.2	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	94
	H-Coal	Wyodak	43.9	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	55.4	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95
		Wyodak	52.8	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 7064)	95
		IL No. 6	54.3	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 6979)	95

(Continued)

Table 183 (Concluded)

Material	Process	Coal Type	Value (Vol %)	Sample Description/Source	Reference
Hydrotreated whole process liquids	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	17.8	From high severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.0; total pressure, 2500 psig; H_2 mean pressure, 2325 psia; recycle gas, 14,550 SCF/bbl)	141
		Pitt-Seams WV (Blackville No. 2 Mine)	34.2	From intermediate severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2500 psig; H_2 mean pressure, 2345 psia; recycle gas, 14,830 SCF/bbl)	141
		Pitt-Seams WV (Blackville No. 2 Mine)	47.7	From low severity hydrotreatment with ICR 106 catalyst, Chevron sample (Operating conditions: average catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2000 psig; H_2 mean pressure, 1765 psia; recycle gas, 8070 SCF/bbl)	141
		NA	48.7	Ft. Lewis pilot plant, moderate severity hydrotreatment	128
		NA	3.9	Ft. Lewis pilot plant, high severity hydrotreatment	129
	H-Coal	Wyodak	11.5	PDU, from medium severity hydrotreatment	128
		IL No. 6	18.5	PDU, from high severity hydrotreatment	128

Table 184. Detailed Hydrocarbon Class Analysis

Material	Process	Coal Type	Compound Class	Value (Vol %)	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	NA	Monocycloparaffins	11.9	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	94
			Bicycloparaffins	8.4		
			Tricycloparaffins	19.9		
			Alkylbenzenes	15.7		
			Indans and tetralins	26.4		
			Dinaphthenebenzenes	3.7		
			Naphthalenes	9.4		
Hydro-treated whole process liquids	NA	--	--	--	--	--

Table 185. Additional Hydrocarbon Compound Class Analysis Obtained by Solvent Fractionation

Material	Process	Coal Type		Value (wt %)	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	Hot Heptane Asphaltenes	0.0468	Ft. Lewis pilot plant (Chevron Sample No. WOW-3666)	86
			Benzene Insolubles	<0.03		
		Pitt-Seams WV (Blackville No. 2 Mine)	Benzene Insolubles	0.03	Ft. Lewis pilot plant	144
	H-Coal	Wyodak	Hot C_7 insolubles	0.0068	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	Hot C_7 insolubles	0.35	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95
		Wyodak	Hot C_7 insolubles	<0.0010	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 7064)	95
		IL No. 6	Hot C_7 insolubles	0.0054	PDU, syncrude mode, rerun whole process liquid (Chevron Sample No. SGQ 6979)	95

(Continued)

Table 185 (Continued)

Material	Process	Coal Type	Value (wt %)		Sample Description/Source	Reference
Coal raw whole process liquids	H-Coal	Wyodak	Pentane solubles and benzene solubles (oils)	54.5	PDU Run 10 (ORNL Sample 27B)	146
			Pentane insolubles and benzene solubles (asphaltenes)	4.5		
			Pyridine solubles and benzene insolubles (preasphaltenes)	4.9		
		Wyodak	Pyridine insolubles and benzene insolubles (residue)	36.1	PDU Run 10 (ORNL Sample 27B)	146
		Wyodak	Pentane solubles benzene solubles (oils)	52.9	PDU Run 10 (ORNL Sample 34A)	146
			Pentane insolubles and benzene solubles (asphaltenes)	8.6		

(Continued)

Table 185 (Continued)

Material	Process	Coal Type	Value (wt %)		Sample Description/Source	Reference
Coal raw whole process liquids	H-Coal	Wyodak	Pyridine solubles and benzene insolubles (preasphaltenes)	5.6	PDU Run 10 (ORNL Sample 34A)	146
			Pyridine insolubles and benzene insolubles (residue)	32.9		
		Wyodak	Pentane solubles and benzene solubles (oils)	59.4	PDU Run 10 (ORNL Sample 42A)	146
			Pentane insolubles and benzene solubles (asphaltenes)	7.2		
			Pyridine solubles and benzene insolubles (preasphaltenes)	4.7		
			Pyridine insolubles and benzene insolubles (residue)	28.7		

(Continued)

Table 185 (Concluded)

Material	Process	Coal Type	Value (wt %)		Sample Description/Source	Reference
Coal raw whole process liquids	H-Coal	Wyodak	Pentane solubles and benzene solubles (oils)	67.8	PDU Run 10 (ORNL Sample 43A)	146
			Pentane insolubles and benzene solubles (asphaltenes)	9.0		
			Pyridine solubles and benzene insolubles (preasphaltenes)	0.7		
			Pyridine insolubles and benzene insolubles (residue)	22.5		
Hydro-treated whole process liquids	NA	--	--		--	--

Table 186. Nitrogen-Containing Compound Classes

Material	Process	Coal Type	Value (wt %)		Sample Description/Source	Reference
Coal raw process liquids	H-Coal	Wyodak	Basic Nitrogen	0.13	PDU, syncrude mode (Chevron Sample No. WOW-4137)	95
		IL No. 6	Basic Nitrogen	0.13/ 0.30	PDU, syncrude mode (Chevron Sample No. WOW-3919)	95
Hydro-treated whole process liquids	NA	--	--		--	--

Table 187. Individual Sulfur-Containing Compounds

Material	Process	Coal Type	Mol Wt	Compound	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-I	KY No. 9		Sulfur Heterocycle Chromatographic Fraction	50 lb/day PDU	139
			134	benzo(b)thiophene*		
			136	2,3-dihydrobenzo[b]thiophene		
			150	C_1-dihydrobenzo[b]thiophene†		
			148	C_1-benzo[b]thiophene		
			150	C_1-dihydrobenzo[b]thiophene		
			148	3-methylbenzo[b]thiophene*		
			150	C_1-dihydrobenzo[b]thiophene		
			164	C_2-dihydrobenzo[b]thiophene		
			164	C_2-dihydrobenzo[b]thiophene		
			164	C_2-dihydrobenzo[b]thiophene		
			164	C_2-dihydrobenzo[b]thiophene		
			164	C_2-dihydrobenzo[b]thiophene		
			162	5-ethylbenzo[b]thiophene*		
			162	C_2-benzo[b]thiophene		
			162	C_2-benzo[b]thiophene		
			162	C_2-benzo[b]thiophene		
			184	dibenzothiophene (and/or naphtho[1,2-b]thiophene)*		
			178, 184	phenanthrene and naphtho[2,1-b]thiophene*		
			198	C_1-dibenzothiophene		
			198	C_1-dibenzothiophene		
			212	C_2-dibenzothiophene		
			212	C_2-dibenzothiophene		
			212	C_2-dibenzothiophene		
			208	phenanthro[4,5-bcd]thiophene		
			222	C_1-phenanthro[4,5-bcd]thiophene		
			222	C_1-phenanthro[4,5-bcd]thiophene		
			234	benzo[b]naphtho[2,1-d]thiophene (and/or benzo[b]naphtho[2,3-d]thiophene)*		
			234	isomers of 47 and 49		
			234	phenanthro[1,2-b]thiophene (and/or phenanthro[4,3-b]thiophene)*		
			248	isomers of C_1-benzo[b]naphtho[2,1-d]thiophene†		
			248	isomers of C_1-benzo[b]naphtho[2,1-d]thiophene†		
			248	isomers of C_1-benzo[b]naphtho[2,1-d]thiophene†		
			262	isomers of C_2-benzo[b]naphtho[2,1-d]thiophene†		
			262	isomers of C_2-benzo[b]naphtho[2,1-d]thiophene†		
			258	triphenyleno[4,5-bcd]thiophene*		

(Continued)

Table 187 (Concluded)

Material	Process	Coal Type	Mol Wt	Compound	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	Pittsburgh No. 8		Sulfur Heterocycle Chromatographic Fraction	Ft. Lewis pilot plant, ORNL Sample No. RCS-UFO-13	139
			134	benzo(b)thiophene*		
			136	2,3-dihydrobenzo[b]thiophene		
			150	C_1-dihydrobenzo[b]thiophene‡		
			150	C_1-dihydrobenzo[b]thiophene		
			148	C_1-benzo[b]thiophene		
			150	C_1-dihydrobenzo[b]thiophene		
			148	3-methylbenzo[b]thiophene*		
			150	C_1-dihydrobenzo[b]thiophene		
			164	C_2-dihydrobenzo[b]thiophene		
			164	C_2-dihydrobenzo[b]thiophene		
			164	C_2-dihydrobenzo[b]thiophene		
			164	C_2-dihydrobenzo[b]thiophene		
			162	5-ethylbenzo[b]thiophene*		
			162	C_2-benzo[b]thiophene		
			184	dibenzothiophene (and/or naphtho[1,2-b]thiophene)*		
			178, 184	phenanthrene and naphtho[2,1-b]thiophene*		
			198	C_1-dibenzothiophene		
			198	C_1-dibenzothiophene		
			198	C_1-dibenzothiophene		
			212	C_2-dibenzothiophene		
			212	C_2-dibenzothiophene		
			212	C_2-dibenzothiophene		
			212	C_2-dibenzothiophene		
			208	phenanthro[4,5-bcd]thiophene		
			222	C_1-phenanthro[4,5-bcd]thiophene		
			222	C_1-phenanthro[4,5-bcd]thiophene		
			234	benzo[b]naphtho[2,1-d]thiophene (and/or benzo[b]naphtho[2,3-d]thiophene)*		
			234	isomers of 47 and 49		
			234	phenanthro[1,2-b]thiophene (and/or phenanthro[4,3-b]thiophene)*		
			248	isomers of C_1-benzo[b]naphtho[2,1-d]thiophene†		
			248	isomers of C_1-benzo[b]naphtho[2,1-d]thiophene†		
			248	isomers of C_1-benzo[b]naphtho[2,1-d]thiophene†		
			258	triphenyleno[4,5-bcd]thiophene*		
Hydro-treated whole process liquids	NA	--	--	--	--	--

Explanatory Notes

* Compounds identified by comparison of retention data and mass spectral information of individual mixture components to standards

† A representative structure of a four-ring thiophenic compound

‡ C = addition of CH_2 group

Table 188. General Physical and Chemical Properties Data for Various Distillation Fractions of Raw and Hydrotreated Whole Process Liquids

Material	Process	Coal Type	Distillation Fraction No.	Distillation Data	Gravity	Pour Point, °F	Molecular Weight		Sample Description/Source	Reference
				50 Wt% Off Temp., °F			Cryoscopic	Vapor Pressure Osmometry		
Coal raw whole process liquids	SRC-II	Powhattan No. 5	1	152	64.4,63.8	<-65	85	NA	PDU P-99	143
			2	211	52.5,52.0	<-65	95	NA		
			3	249	52.5,52.2	<-65	108	NA		
			4	279	42.7,42.6	<-65	114	NA		
			5	332	27.0,26.2,26.3	<-65	131	118		
			6	384	17.2,16.5	<-65	126	128		
			7	428	15.6,15.5	<-65	140	137		
			8	485	13.6,13.3,13.5	-45	154	163		
			9	526	13.2,12.5	-30	NA	156		
			10	572	10.5,10.3	0	NA	166		
			11	648	5.1,4.4,4.5	40	NA	230,214		
			12	711	0.0,-0.8	65	NA	246,247		
			13	749	-2.1,-1.7	85	NA	243		
			14*	570	7.4,7.5	15	NA	189		
			15	696	0.0,.-0.3	70	NA	214		
			16	757	-2.2,-2.9,-3.2	85	NA	238,247		
			17	821	-5.2,-5.0	100	NA	251		
			18	890	-8.9,-12.9	150	NA	310,304		
			19	969	-13.1	210	NA	363,320		

(Continued)

Table 188 (Continued)

Material	Process	Coal Type	Distillation Fraction	API Gravity	Viscosity (Centistokes)	GC Simulated Distillation	Gum Content (mg/100 ml)	Freeze Point (°F)	Sample Description/Source	Reference
Coal raw whole process liquids	H-Coal	Wyodak	C_5-180°F	69.7	NA	18/45°F-IBP/5 83/136°F-10/30 159°F-50 172/187°F-70/90 192/200°F-95/99	NA	NA	PDU, syncrude mode	95
			180-250°F	53.7	NA	152/178°F-IBP/5 182/207°F-10/30 224°F-50 232/251°F-70/90 259/273°F-95/99	NA	NA		
			250-300°F	46.6	NA	203/245°F-IBP/5 252/272°F-10/30 283°F-50 296/313°F-70/90 323/332°F-95/99	NA	NA		
			300-350°F	37.9	2.581 (100°F) 1,194 (130°F)	244/298°F-IBP/5 305/323°F-10/30 337°F-50 350/363°F-70/90 368/375°-95/99	NA	NA		
			350°F+	23.0	NA	298/361°F-IBP/5 374/416°F-10/30 457°F-50 514/649°F-70/90 677/785°F-95/99	NA	NA		
		IL No. 6	250°F$^+$	36.3	NA	589°F-EP	500	NA	250°F$^+$ distillate, PDU, syncrude mode	95
			250°F$^+$	37.8	NA	530°F-EP	2	NA	250°F$^+$ rerun distillate, PDU, syncrude mode	95
		Wyodak	250°F$^+$	39.4	NA	591°F-EP	~500	-27	250°F$^+$ distillate, PDU, syncrude mode	95
			250°F$^+$	39.3	NA	<572°F-EP	Probably <7	<-94	250°F$^+$ rerun distillate, PDU, syncrude mode	95

(Continued)

Table 188 (Continued)

Material	Process	Coal Type	API Gravity	Aniline Point(°F)	Research Octane No. F-1(Clear)	Distillation (% Evaporation)	Pour Point(°F)	Freeze Point(°F)	Cetane No.	Viscosity (Centistokes)	Smoke Point (mm)	Sample Description/Source	Reference
Hydro-treated whole process liquids	SRC-II	NA	47.7	95.1	63.3	156/181°F-IBP/5 214/230°F-10/30 270°F-50 301/341°F-70/90 348/363°F-95/99	NA	NA	NA	NA	NA	180-350°F cut, high severity hydrotreatment with ICR 106 catalyst	141
			46.8	86.1	66.8	160/188°F-IBP/5 215/234°F-10/30 271°F-50 301/340°F-70/90 349/363°F-95/99	NA	NA	NA	NA	NA	180-350°F cut, medium severity hydrotreatment with ICR 106 catalyst	
			45.7	78.8	72.2	157/180°F-IBP/5 212/231°F-10/20 269°F-50 297/336°F-70/90 346/363°F-95/99	NA	NA	NA	NA	NA	180-350°F cut, low severity hydrotreatment with ICR 106 catalyst	
			29.3	105.5	NA	326/360°F-IBP/5 368/400°F-10/30 437°F-50 481/554°F-70/90 603/708°F-95/99	NA	NA	38.7	2.19 (100°F)	14	350°F+ cut, high severity hydrotreatment with ICR 106 catalyst	
			24.7	59.6	NA	325/360°F-IBP/5 371/410°F-10/30 448°F-50 492/570°F-70/90 624/735°F-95/99	<-80	<-94	27.4	2.23 (100°F)	10	350°F+ cut, medium severity hydrotreatment with ICR 106 catalyst	
			20.6	<32	NA	329/363°F-IBP/5 391/417°F-10/30 451°F-50 496/585°F-70/90 648/771°F-95/99	NA	NA	<<21	2.24 (100°F)	6	350°F+ cut, low severity hydrotreatment with ICR 106 catalyst	

(Continued)

Table 188 (Concluded)

Material	Process	Coal Type	Distillation Fraction	API Gravity	Octane No. F-1, Clear	Octane No. F-2, Clear	Distillation Data (°F)	GC Simulated Distillation	Sample Description/Source	Reference
Hydrotreated whole process liquids	H-Coal	IL No. 6	C_5-180°F	73.8	88.6	83.1	96/111°F-IBP/5 115/126°F-10/30 139°F-50 151/161°F-70/90 165/167°F-95/EP	NA	From 315°F extinction recycle hydrocracking of denitrified whole coal liquid Chevron Sample No. WOW-4022 over fresh ICR 202 catalyst, PDU Run 62-266, Run Hours 339-363. Operating conditions: average catalyst temperature, 580°F; LHSV, 1.70.	95
			180-315°F	51.1	68.5	69.5	213/222°F-IBP/5 225/236°F-10/30 249°F-50 268/296°F-70/90 305/348°F-95/EP	160/192°F-IBP/5 199/224°F-10/30 252°F-50 284/320°F-70/90 327/335°F-95/99		
		IL No. 6	C_5-180°F	72.9	88.5	82.8	96/112°F-IBP/5 117/128°F-10/30 138°F-50 146/160°F-70/90 165/167°F-95/EP	NA	From 315°F extinction recycle hydrocracking of denitrified whole coal liquid Chevron Sample No. WOW-4022 over fresh ICR 202 catalyst, PDU Run 62-266, Run Hours 363-387. Operating conditions: average catalyst temperature, 450°F; LHSV, 1.70.	95
			180-315°F	51.5	69.2	70.0	210/222°F-IBP/5 226/236°F-10/30 246°F-50 262/291°F-70/90 301/336°F-95/EP	160/192°F-IBP/5 200/225°F-10/30 253°F-50 284/317°F-70/90 324/332°F-95/99		
		IL No. 6	C_5-180°F	72.3	88.3	83.1	100/116°F-IBP/5 120/131°F-10/30 142°F-50 153/162°F-70/90 166/170°F-95/EP	NA	From 315°F extinction recycle hydrocracking of denitrified whole coal liquid Chevron Sample No. WOW-4022 over fresh ICR 202 catalyst, PDU Run 62-266, Run Hours 435-459. Operating conditions: average catalyst temperature, 583°F; LHSV, 1.70.	95
			180-315°F	51.4	69.0	69.8	210/223°F-IBP/5 226/234°F-10/30 248°F-50 265/294°F-70/90 300/310°F-95/EP	161/193°F-IBP/5 200/225°F-10/30 254°F-50 285/318°F-70/90 324/331°F-95/99		

Explanatory Notes

*405-710°F front-end material obtained from second distillation, Sample No. 80-D-14.

Table 189. Elemental Composition Data for Various Distillation Fractions for Raw and Hydrotreated Whole Process Liquids

Material	Process	Coal Type	Distillation Fraction	50 wt% Off Temp °F	Elemental Composition, Wt % (Dry Basis)					Sample Description/Source	Reference
					C	H	N	O	S		
Coal raw whole process liquids	SRC-II	Powhattan No. 5	No. 1	152	84.28	14.43	0.55	0.67	0.07	PDU P-99	143
			No. 2	211	86.02	13.33	0.24	0.33	0.08		
			No. 3	249	85.73	13.66	0.27	0.24	0.10		
			No. 4	279	87.22	12.44	0.11	0.08	0.15		
			No. 5	332	83.98	10.48	0.36	4.70	0.48		
			No. 6	384	83.56	9.49	0.82	6.06	0.07		
			No. 7	428	84.61	9.35	0.72	5.19	0.13		
			No. 8	485	86.12	9.25	1.17	3.15	0.31		
			No. 9	526	87.35	9.64	0.85	1.95	0.21		
			No. 10	572	88.33	8.96	0.76	1.78	0.17		
			No. 11	648	88.84	8.13	1.10	1.59	0.34		
			No. 12	711	89.08	7.68	1.13	1.87	0.24		
			No. 13	749	90.38	7.70	1.28	0.27	0.37		
			No. 14	570	88.12	8.37	0.90	2.29	0.32		
			No. 15	696	88.66	7.66	1.31	1.90	0.47		
			No. 16	757	89.10	7.34	1.39	1.81	0.36		
			No. 17	821	88.70	7.27	1.56	2.03	0.44		
			No. 18	890	88.63	7.02	1.75	1.99	0.61		
			No. 19	969	89.31	6.32	1.82	1.98	0.57		
	H-Coal	Wyodak	C_5-180	NA	NA	NA	0.38	0.50	0.0211	PDU, syncrude mode	95
			180-250	NA	NA	NA	0.014	0.12	0.0256		
			250-300	NA	NA	NA	0.0415	0.90	0.0438		
			300-350	NA	NA	NA	0.1435	1.43	0.0430		
			350°F+	NA	NA	NA	0.25	NA	0.0240		

(Continued)

Table 189 (Concluded)

Material	Process	Coal Type	Distillation Fraction	50 wt% Off Temp °F	Elemental Composition, Wt % (Dry Basis)					Sample Description/Source	Reference
					C	H	N	O	S		
Hydrotreated whole process liquids	SRC-II	NA	NA	NA	NA	13.8	NA	NA	NA	180-350°F cut, high severity hydrotreatment with ICR 106 catalyst	141
			NA	NA	NA	13.5	0.00073	NA	NA	180-350°F cut, medium severity hydrotreatment with ICR 106 catalyst	
			NA	NA	NA	13.3	0.0119	0.3200	NA	180-350°F cut, low severity hydrotreatment with ICR 106 catalyst	
			NA	NA	NA	13.3	0.00005	NA	NA	350°F$^+$ cut, high severity hydrotreatment with ICR 106 catalyst	
			NA	NA	NA	NA	0.0023	NA	NA	350°F$^+$ cut, medium severity hydrotreatment with ICR 106 catalyst	
			NA	NA	NA	NA	0.0702	0.5500	NA	350°F$^+$ cut, low severity hydrotreatment with ICR 106 catalyst	

Table 190. Hydrocarbon Analysis (Aromatics and Saturates Content) of Various Distillation Fractions for Raw and Hydrotreated Whole Process Liquids

Material	Process	Coal Type	Distillation Fraction	Value (vol %)		Sample Description/Source	Reference
				Aromatics	Saturates		
Coal raw whole process liquids	H-Coal	Wyodak	C_5-180*	3.3	96.7	PDU, syncrude mode	95
			180-250	8.7	91.3		
			250-300	16.6	83.4		
			300-350	22.6	77.5		
			350°F$^+$	55.0	45.0		
Hydrotreated whole process liquids	SRC-II	NA	NA	13.1	87.0	180-350°F cut, high severity hydrotreatment with ICR 106 catalyst	141
			NA	19.1	80.9	180-350°F cut, medium severity hydrotreatment with ICR 106 catalyst	
			NA	23.2	76.8	180-350°F cut, low severity hydrotreatment with ICR 106 catalyst	
			NA	22.9	77.1	350°F$^+$ cut, high severity hydrotreatment with ICR 106 catalyst	
			NA	50.3	49.7	350°F$^+$ cut, medium severity hydrotreatment with ICR 106 catalyst	
			NA	66.8	33.2	350°F$^+$ cut, low severity hydrotreatment with ICR 106 catalyst	

Explanatory Notes

*Determined by low resolution mass spectrometry.

Table 191. Detailed Hydrocarbon Class/Compound Analysis for Various Distillation Fractions for Raw and Hydrotreated Whole Process Liquids*

Material	Process	Coal Type	Compound Class	Value (Vol %)	Sample Description/Source	Reference
Coal raw whole process liquid	NA	--	--	--	--	--
			Paraffins			
Hydro-treated whole process liquids	SRC-II	NA	C_6	0.07	180-350°F cut, high severity hydrotreatment with ICR 106 catalyst	141
			C_7	2.9		
			C_8	3.1		
			C_9	2.4		
			C_{10}	0.9		
			C_{11}	ND		
			Total Paraffins	9.4		
			Naphthenes			
			C_6	4.8		
			C_7	22.9		
			C_8	21.6		
			C_9	19.2		
			C_{10}	9.0		
			C_{11}	ND		
			Total Naphthenes†	77.5		
			Aromatics			
			C_6	0.1		
			C_7	3.5		
			C_8	4.9		
			C_9	4.5		
			C_{10}	0.1		
			Total Aromatics	13.1		

(Continued)

Table 191 (Continued)

Material	Process	Coal Type	Compound Class	Value (Vol %)	Sample Description/Source	Reference
Hydro-treated whole process liquids	SRC-II	NA	Paraffins		180-350°F cut, medium severity hydrotreatment with ICR 106 catalyst	141
			C_6	0.05		
			C_7	3.1		
			C_8	3.4		
			C_9	1.7		
			C_{10}	1.0		
			C_{11}	0.2		
			Total Paraffins	9.5		
			Naphthenes			
			C_6	4.0		
			C_7	22.4		
			C_8	19.9		
			C_9	17.7		
			C_{10}	7.3		
			C_{11}	0.1		
			Total Naphthenes‡	71.4		
			Aromatics			
			C_6	0.1		
			C_7	4.8		
			C_8	7.3		
			C_9	5.1		
			C_{10}	1.8		
			Total Aromatic	19.1		

(Continued)

Table 191 (Continued)

Material	Process	Coal Type	Compound Class	Value (Vol %)	Sample Description/Source	Reference
Hydro-treated whole process liquids	SRC-II	NA	Paraffins			141
			C_6	0.2	180-350°cut, low severity hydrotreatment with ICR 106 catalyst	
			C_7	3.3		
			C_8	3.7		
			C_9	2.8		
			C_{10}	1.2		
			C_{11}	0.1		
			Total Paraffins	11.3		
			Naphthenes			
			C_6	5.2		
			C_7	20.6		
			C_8	17.4		
			C_9	15.2		
			C_{10}	6.6		
			C_{11}	0.5		
			Total Naphthenes	65.6		
			Aromatics			
			C_6	0.4		
			C_7	5.6		
			C_8	8.5		
			C_9	6.0		
			C_{10}	2.7		
			Total Aromatics	23.2		

(Continued)

Table 191 (Continued)

Material	Process	Coal Type	Compound Class	Value (Vol %)	Sample Description/Source	Reference
Hydrotreated whole process liquids	SRC-II	NA	Total Paraffins	6.5	350°F$^+$ cut, high severity hydrotreatment with ICR 106 catalyst	141
			Cycloparaffins	2.4		
			Dicycloparaffins	47.5		
			Tricycloparaffins	20.7		
			Total Naphthenes	70.6		
			Alkylbenzenes	5.1		
			Indans/Tetralins	15.2		
			Benzodicycloparaffins	1.2		
			Naphthalenes	0.2		
			Benzoindans/Benzotetralins	1.2		
			Total Aromatics	22.9		
			Total Paraffins	4.7	350°F$^+$ cut, medium severity hydrotreatment with ICR 106 catalyst	
			Cycloparaffins	9.9		
			Dicycloparaffins	22.9		
			Tricycloparaffins	12.2		
			Total Naphthenes	45.0		
			Alkylbenzenes	9.5		
			Indans/Tetralins	34.9		
			Benzodicycloparaffins	3.5		
			Naphthalenes	1.1		
			Benzoindans/Benzotetralins	1.4		
			Total Aromatics	50.4		

(Continued)

Table 191 (Concluded)

Material	Process	Coal Type	Compound Class	Value (Vol %)	Sample Description/Source	Reference
Hydrotreated whole process liquids	SRC-II	NA	Total Paraffins	5.2	350°F$^+$ cut, low severity hydrotreatment with ICR 106 catalyst	141
			Cycloparaffins	6.6		
			Dicycloparaffins	9.7		
			Tricycloparaffins	11.7		
			Total Naphthenes	28.0		
			Alkylbenzenes	11.5		
			Indans/Tetralins	43.8		
			Benzodicycloparaffins	5.3		
			Naphthalenes	2.5		
			Benzoindans/ Benzotetralins	3.7		
			Total Aromatics	66.8		

Explanatory Notes

*Distribution by chromatography.

†Includes 6.4 vol % dicycloparaffins (by mass spectroscopy).

‡Includes 5.5 vol % dicycloparaffins (by mass spectroscopy).

Table 192. Additional Detailed Hydrocarbon Class/Compound Analysis for Various Distillation Fractions for Raw and Hydrotreated Whole Process Liquids

Material	Process	Coal Type			Distillation Fraction No. 50 Wt % Off Temp, °F	1 152	2 211	3 249	4 279	5 332	6 384	7 428	8 485	9 526	10 572	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	Powhattan No. 5	Saturates:		Total, Wt % of Sample	86.0	76.0	76.5	59.0	39.0	16.5	14.5	12.0	5.5	4.0	PDU-99	143
					Paraffins, Wt % of Saturates	35.4	31.3	38.6	26.7	26.9	41.7	53.0	54.4	59.2	54.1		
					Cycloparaffins: Non-Condensed	64.2	68.2	61.2	72.2	63.7	32.0	30.8	19.8	23.4	33.2		
					2 Rings	0.0	0.0	0.0	0.7	8.6	23.6	12.7	16.2	9.0	7.1		
					3 Rings	0.2	0.2	0.1	0.2	0.2	2.1	2.9	7.6	6.4	4.2		
					Alkylbenzenes	0.2	0.2	0.2	0.3	0.6	0.6	0.6	1.9	2.0	1.5		
			Aromatics:		Total, Wt % of Sample	6.0	15.2	13.5	33.0	56.0	81.5	82.0	80.5	93.0	94.0		
				Z* -28	Benzopyrenes, Wt % of Aromatics	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0		
				-24	Chrysenes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2		
				-12	Decahydropyrenes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	1.8		
				-16	Hexahydropyrenes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	2.3		
				-18	Tetrahydrofluoranthenes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.0		
				-22	Pyrenes - Fluoranthenes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.0		
				-20	Dihydropyrenes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.8	0.6		
				-10	Octahydrophenanthrenes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	9.0	16.3		
				-12	Hexahydrophenanthrenes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.3	3.6		
				-14	Tetrahydrophenanthrenes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	5.7	41.0		
				-18	Phenanthrenes	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.3	0.3	0.0		
				-16	Fluorenes-Dihydrophenanthrenes	0.0	0.0	0.2	0.0	0.0	0.1	0.1	0.3	1.5	10.0		
				-14	Acenaphthenes-Biphenyls	0.0	0.2	0.3	0.0	0.1	0.1	0.1	2.7	11.9	3.8		
				-8	Tetralins	0.0	0.0	1.9	3.9	13.9	29.0	25.2	25.9	15.2	2.6		
				-10	Tetrahydroacenaphthenes	0.0	0.0	0.0	0.0	0.0	0.2	1.4	3.8	9.4	1.3		
				-12	Naphthalenes	0.0	0.0	0.1	0.0	0.0	1.2	11.2	30.9	28.7	6.8		
				-6	Benzenes	100.0	99.8	92.5	82.4	39.3	10.2	2.1	5.7	1.5	2.2		
					Naphthols	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.5	4.8	0.0		
					Dihydroxybenzenes	0.0	0.0	0.0	0.0	0.7	2.5	1.8	1.5	1.2	0.9		
					Phenols	0.0	0.0	4.8	13.7	46.1	56.6	57.9	23.0	6.8	5.6		
			Olefins:		Total, Wt % of Sample	8.0	9.5	10.0	8.0	5.0	2.0	2.0	7.6†	0.0	1.0		

Table 192 (Concluded)

Material	Process	Coal Type	Formula	Distillation Fraction No. 50 Wt % Off Temp, °F Group Type, % of Aromatics‡	9 152	10 211	11 249	12 711	13 749	14 570	15 696	16 757	17 821	18 890	19 969	Sample Description/Source	Reference
Coal raw whole process liquids	SRC-II	Powhattan No. 6	C22H24	Decahydrobenzchrysene	0.0	0.0	0.0	0.1	1.2	0.1	0.9	1.6	4.2	7.4	13.2	PDU-99†	143
			C22H22	Octahydrobenzchrysene	0.0	0.0	0.0	0.3	1.0	0.2	0.9	1.9	4.6	7.6	7.4		
			C22H20	Hexahydrobenzchrysene	0.0	0.0	0.0	0.2	0.7	0.1	0.6	1.5	3.5	8.5	5.6		
			C22H18	Tetrahydrobenzchrysene	0.0	0.0	0.1	0.3	0.5	0.1	0.5	1.2	2.6	8.8	10.9		
			C22H14	Benzochrysene	0.0	0.0	0.1	0.6	1.3	0.2	0.6	0.9	1.6	5.6	11.3		
			C20H22	Decahydrobenzpyrene	0.0	0.0	0.1	1.2	3.8	0.4	1.6	2.6	3.6	4.7	8.7		
			C20H20	Octahydrobenzpyrene	0.0	0.0	0.5	2.5	8.9	1.2	4.1	6.8	9.7	5.4	1.8		
			C20H18	Hexahydrobenzpyrene	0.0	0.0	0.6	1.4	6.5	1.1	3.5	7.6	11.1	6.9	2.1		
			C20H16	Tetrahydrobenzpyrene	0.0	0.0	0.1	0.4	0.9	0.3	0.9	2.3	3.9	4.1	2.1		
			C20H14	Dihydrobenzpyrene	0.0	0.0	0.3	0.8	1.0	0.5	1.1	2.4	4.3	7.2	0.0		
			C20H12	Benzopyrene	0.0	0.0	0.9	1.8	1.9	0.7	1.6	2.6	4.9	15.6	14.1		
			C18H24	Dodecahydrochrysene	0.0	0.0	1.5	1.5	1.2	0.9	1.5	2.7	4.4	1.9	0.0		
			C18H20	Octahydrochrysene	0.1	0.0	4.9	9.3	6.7	2.2	5.1	4.3	3.8	0.0	0.0		
			C18H18	Hexahydrochrysene	0.0	0.0	0.2	4.6	5.9	0.5	2.2	2.9	2.8	0.0	0.0		
			C18H12	Chrysene	0.0	0.1	0.0	0.0	0.2	0.2	0.5	5.2	6.0	1.3	0.0		
			C16H20	Decahydropyrene	0.1	1.8	5.6	4.7	3.0	5.1	6.2	6.3	1.3	0.0	0.8		
			C16H16	Hexahydropyrene	0.4	2.4	22.0	11.3	4.8	12.9	15.6	6.4	2.2	1.5	5.4		
			C16H14	Tetrahydrofluoranthene	0.3	0.0	4.9	7.4	1.6	2.2	4.8	3.0	0.3	0.0	0.0		
			C16H10	Pyrenefluoranthene	0.7	0.8	1.0	23.3	24.2	2.0	7.3	14.6	10.3	1.1	1.1		
			C16H12	Dihydropyrene/Tetrahydrochrysene	1.1	0.9	7.3	19.0	22.7	6.0	13.1	11.0	10.6	4.0	2.7		
			C14H18	Octahydrophenanthrene	8.3	14.2	0.0	0.0	0.0	2.3	0.0	12.6	0.9	2.7	4.4		
			C14H16	Hexahydrophenanthrene	1.6	4.8	1.8	0.0	0.0	4.3	1.5	0.0	0.0	0.0	1.4		
			C14H14	Tetrahydrophenanthrene	5.1	36.2	28.9	5.5	0.0	36.4	19.0	0.0	0.0	0.1	5.4		
			C14H10	Phenanthrene	0.5	1.2	13.7	0.0	0.0	8.0	6.8	1.0	0.0	0.0	0.0		
			C13H10	Fluorene/Dihydrophenanthrene	2.3	15.1	0.0	0.0	0.0	6.2	0.0	0.0	0.0	0.5	1.1		
			C12H10	Acenaphthene/Biphenyl	12.7	5.8	0.0	0.0	0.3	0.0	0.0	0.0	0.9	0.2	0.0		
			C10H12	Tetralin/Phenylcyclohexane	16.1	3.8	2.4	1.7	0.0	3.5	0.0	0.0	0.0	0.0	0.0		
			C12H14	Tetrahydroacenaphthene	6.6	0.3	2.8	2.3	1.6	1.7	1.5	0.0	0.0	0.0	0.0		
			C10H8	Naphthlene	32.3	9.7	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.9	0.7		
			C6H6	Benzene	4.9	2.8	0.3	0.0	0.1	0.0	0.0	0.8	3.8	3.3	0.0		
Hydro-treated whole process liquids	NA	--	--	--						--						--	--

Explanatory Notes

*Mass spectral analysis for group types in saturates and total aromatics subfractions.

†Appears to be too large a value for this fraction; value may be erroneous because of difficulty in observing the dye interface between the aromatic and olefin groups.

‡Spectral analysis for non-polar aromatics subfraction

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Table 193. Individual Hydrocarbon Compound Analysis for Various Distillation Fractions for Raw and Hydrotreated Whole Process Liquids*,†

Material	Process	Coal Type	Mass Spectrometric Peak Number	Molecular Weight	Compound	Sample Description/Source	Reference
Coal raw whole process liquid	SRC-II	Powhattan No. 5	1	118	Indan	PDU P-99	142
			2	132	C_1-Indan		
			3	132	Tetralin (1,2,3,4-tetrahydronaphthalene)		
			4	128	Naphthalene		
			5	146	C_1-Tetralin		
			6	142	C_1-Naphthalene		
			7	160	C_2-Tetralin		
			8	154	Biphenyl		
			9	156	C_2-Naphthalene		
			10	170	C_3-Naphthalene		
			11	168	C_1-Biphenyl		
			12	184	C_4-Naphthalene		
			13	166	Fluorene		
			14	198	C_5-Naphthalene		
			15	192	C_2-Biphenyl		
			16	180	C_1-Fluorene		
			17	184	Dibenzothiophene		
			18	178	Phenanthrene		
			19	198	C_2-Fluorene		
			20	206	C_3-Biphenyl		
			21	204	Phenylnaphthalene		
			22	192	C_1-Phenanthrene		
			23	204	Phenylnaphthalene		
			24	206	C_2-Phenanthrene		
			25	202	Fluoranthene		
			26	202	Pyrene		
			27	216	C_1-Pyrene		
			28	216	Benzofluorene		
			29	230	C_2-Pyrene		
			30	244	C_3-Pyrene		
			31	228	Chrysene		
			32	258	C_4-Pyrene		
Hydrotreated whole process liquid	NA	--	--	--	--	--	--

Explanatory Notes

*Obtained via capillary column gas chromatography of HPLC fractions.

†Analysis of the 867-967°F cut indicated the presence of the following compounds: Chrysene, benzanthracene, perylene, benzoperylene, dibenzofluranthenes, coronene, azabenzpyrenes, azaperylenes and certain hydroxy- and amino-derivatives (Reference 142).

Part VII. Coal Liquid Intermediates

Table 194. Specific Gravity

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal liquid inter-mediates	SRC-I	KY No 9 and 14	1.09	Ft. Lewis pilot plant, process solvent	83
		KY No. 9 and 14	0.984	Ft. Lewis pilot plant, wash solvent	83
	EDS	IL No. 6	0.9901 (60/60°F)	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99
		IL No. 6 (Monterey Mine)	0.97 ± 0.02	One tpd pilot plant, process solvent; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	0.99 ± 0.01	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6 (Monterey Mine)	0.97 ± 0.01	75 lb per day development unit, process solvent; average of six operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		IL No. 6 (Monterey Mine)	0.96 ± 0.01	75 lb per day development unit, process solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time, average of 21 yield periods	99
		IL No. 6	0.9593 (60/60°F)	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		IL No. 6 (Monterey Mine)	0.94 ± 0.02	One tpd pilot plant, hydrogenated recycle solvent; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99

(Continued)

Table 194 (Continued)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal liquid inter-mediates	EDS	IL No. 6 (Monterey Mine)	0.96 ± 0.01	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6	1.1151 (60/60°F)	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		IL No. 6 (Monterey Mine)	1.15 ± 0.03	One tpd pilot plant, vacuum gas oil; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	1.12 ± 0.07	One tpd pilot plant, vacuum gas oil; operating conditions: 840°F reactor temperature; 40 minutes residence time; average of ten yield periods	99
		IL No. 6	1.11 (60/60°F)	One tpd pilot plant, coker gas oil from "typical" run	99
		IL No. 6	1.2800 (60/60°F)	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		Wyodak	0.9590 (60/60°F)	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99
		Wyodak	0.98 ± 0.01	One tpd pilot plant, process solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99

(Continued)

Table 194 (Continued)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal liquid intermediates	EDS	Wyodak	0.96 ± 0.01	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	0.98 ± 0.01	75 lb per day development unit; process solvent; average of eight operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		Wyodak	0.99 ± 0.01	75 lb per day development unit; process solvent; operating conditions: 880°F reactor temperature, 25 minutes residence time, average of six yield periods	99
		Wyodak	0.9450 (60/60°F)	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		Wyodak	0.94 ± 0.01	One tpd pilot plant, hydrogenated recycle solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	0.94 ± 0.01	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	1.1210 (60/60°F)	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99

(Continued)

Table 194 (Concluded)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal liquid inter-mediates	EDS	Wyodak	1.12 ± 0.08	One tpd pilot plant, vacuum gas oil; average of six operating conditions (800-840°F reactor temperature; 40-100 minutes residence time)	99
		Wyodak	1.11 ± 0.06	One tpd pilot plant, vacuum gas oil; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	1.1540 (60/60°F)	One tpd pilot plant, coker gas oil from "typical" run	99
		Wyodak	1.2899 (60/60°F)	One tpd pilot plant, coker scrubber liquids from "typical" run	99
	H-Coal	IL No. 6 (Burning Star Mine)	0.8733	PDU, blend of atmospheric still overhead and bottoms	144
		IL No. 6 (Burning Star Mine)	0.935	PDU, syncrude mode, blend of atmospheric still overhead and vacuum still overhead	97
		IL No. 6 (Burning Star Mine)	0.953	PDU, fuel oil mode, blend of atmospheric still overhead and vacuum still overhead	97

Table 195. API Gravity

Material	Process	Coal Type	Value (Degrees)	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	NA	5.7	Wilsonville pilot plant, process solvent	84
		NA	7.7	Wilsonville pilot plant, process solvent	119
		NA	18.6	Wilsonville pilot plant, wash solvent	84
	EDS	IL No. 6	11.4	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99
		IL No. 6	10.0	One tpd pilot plant, process solvent	99
		IL No. 6 (Monterey Mine)	18	One tpd pilot plant, process solvent	104
		IL No. 6 (Monterey Mine)	15.57 ± 4.29	One tpd pilot plant, process solvent; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	11.41 ± 1.14	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods.	99
		IL No. 6 (Monterey Mine)	14.58 ± 2.78	75 lb per day development unit, process solvent; average of six operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		IL No. 6 (Monterey Mine)	16.24 ± 2.61	75 lb per day development unit, process solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time, average of 21 yield periods	99

(Continued)

Table 195 (Continued)

Material	Process	Coal Type	Value (Degree)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	IL No. 6	16.0	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		IL No. 6 (Monterey Mine)	18.99 ± 2.70	One tpd pilot plant, hydrogenated recycle solvent; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	16.00 ± 1.55	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6	-4.6	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		IL No. 6 (Monterey Mine)	-8.37 ± 3.26	One tpd pilot plant, vacuum gas oil; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	-4.61 ± 7.72	One tpd pilot plant, vacuum gas oil; operating conditions: 840°F reactor temperature; 40 minutes residence time; average of ten yield periods	99
		IL No. 6	-4.0	One tpd pilot plant, coker gas oil from "typical" run	99
		IL No. 6	-21.0	One tpd pilot plant, coker scrubber liquids from "typical" runs	99
		Wyodak	16.1	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99

(Continued)

Table 195 (Continued)

Material	Process	Coal Type	Value (Degrees)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	Wyodak	13.45 ± 1.83	One tpd pilot plant, process solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	15.93 ± 1.53	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	13.32 ± 1.74	75 lb per day development unit; process solvent; average of eight operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		Wyodak	11.99 ± 1.23	75 lb per day development unit; process solvent; operating conditions: 880°F reactor temperature, 25 minutes residence time, average of six yield periods	99
		Wyodak	18.50 ± 1.47	One tpd pilot plant, hydrogenated recycle solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	19.38 ± 1.33	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99

(Continued)

Table 195 (Continued)

Material	Process	Coal Type	Value (Degrees)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	Wyodak	-4.87 ± 8.20	One tpd pilot plant, vacuum gas oil; average of six operating conditions (800-840°F reactor temperature; 40-100 minutes residence time)	99
		Wyodak	-4.14 ± 7.38	One tpd pilot plant, vacuum gas oil; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	18.2	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		Wyodak	-5.3	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		Wyodak	-8.5	One tpd pilot plant, coker gas oil from "typical" run	99
		Wyodak	-21.8	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		NA	16.0	One tpd pilot plant, hydrogenated recycle solvent	84
		NA	17.1	One tpd pilot plant, hydrogenated recycle solvent, reprocessed to remove 650°F fraction	84
	H-Coal	IL No. 6	32.6	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, atmospheric still overhead*,†	155
		IL No. 6	31.6	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, atmospheric still overhead*,†	155

(Continued)

Table 195 (Continued)

Material	Process	Coal Type	Value (Degrees)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	26.2	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, atmospheric still overhead[*,†]	155
		KY No. 11	32.5	PDU Run 9, Period 6AB, syncrude mode, atmospheric still overhead[‡,§]	156
		KY No. 11	33.2	PDU Run 9, Period 12AB, syncrude mode, atmospheric still overhead[‡,§]	156
		KY No. 11	32.9	PDU Run 9, Period 18AB, syncrude mode, atmospheric still overhead[‡,§]	156
		KY No. 11	31.9	PDU Run 9, Period 23AB, syncrude mode, atmospheric still overhead[‡,§]	156
		KY No. 11	36.3	PDU Run 9, Period 28AB, syncrude mode, atmospheric still overhead[‡,§]	156
		IL No. 6	4.2	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, vacuum still overhead[*,†]	155
		IL No. 6	3.5	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, vacuum still overhead[*,†]	155
		IL No. 6	6.3	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, vacuum still overhead[*,†]	155
		KY No. 11	4.6	PDU Run 9, Period 6AB, syncrude mode, vacuum still overhead[‡,§]	156
		KY No. 11	2.8	PDU Run 9, Period 12AB, syncrude mode, vacuum still overhead[‡,§]	156

(Continued)

Table 195 (Continued)

Material	Process	Coal Type	Value (Degrees)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	KY No. 11	4.1	PDU Run 9, Period 18AB, syncrude mode, vacuum still overhead‡,§	156
		KY No. 11	2.5	PDU Run 9, Period 23AB, syncrude mode, vacuum still overhead‡,§	156
		KY No. 11	2.8	PDU Run 9, Period 28AB, syncrude mode, vacuum still overhead‡,§	156
		IL No. 6 (Burning Star Mine)	19.8	PDU, fuel oil mode, blend of atmospheric still overhead and vacuum still overhead (analyzed by BETC)#	97
		IL No. 6 (Monterey Mine)	17.0	PDU, syncrude mode, blend of atmospheric still overhead and vacuum still overhead (analyzed by BETC)#	97
		IL No. 6	11.1	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, atmospheric still bottoms*,†	155
		IL No. 6	9.8	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, atmospheric still bottoms*,†	155
		IL No. 6	10.9	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, atmospheric still bottoms*,†	155
		KY No. 11	10.1	PDU Run 9, Period 18AB, syncrude mode, atmospheric still bottoms‡,§	156
		KY No. 11	9.4	PDU Run 9, Period 23AB, syncrude mode, atmospheric still bottoms‡,§	156
		KY No. 11	10.9	PDU Run 9, Period 28AB, syncrude mode, atmospheric still bottoms‡,§	156

(Continued)

Table 195 (Concluded)

Material	Process	Coal Type	Value (Degrees)	Sample Description/Source	Reference
Coal liquid inter-mediates	H-Coal	KY No. 11	10.4	PDU Run 9, Period 6AB, syncrude mode, atmospheric still bottoms‡,§	156
		KY No. 11	10.3	PDU Run 9, Period 12AB, syncrude mode, atmospheric still bottoms‡,§	156
		NA	9.8	PDU, atmospheric still bottoms	84
		IL No. 6 (Burning Star Mine)	30.5	PDU, blend of atmospheric still overhead and bottoms	144

Explanatory Notes

*See General Comments section, Note 2, for summary of operating conditions used.

†Periods 3AB, 11B and 20AB are considered representative periods for the entire PDU Run 8, which consisted of over 32 individual periods.

‡See General Comments section, Note 3, for summary of operating conditions used.

§Periods 6AB, 12AB, 18AB, 23AB and 28AB are considered representative periods for the entire PDU Run 9, which consisted of over 30 individual periods.

#See Part VIII, General Comments section, Note 3, for summary of operating conditions used.

Table 196. Density

Material	Process	Coal Type	Value (g/ml)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	NA	0.9787	One tpd pilot plant, process solvent (DuPont "Notebook" Sample No. 16928)	91
		NA	1.17*	One tpd pilot plant, vacuum gas oil (DuPont "Notebook" Sample No. 16928)	91
		NA	1.111†	One tpd pilot plant, heavy gas oil (DuPont "Notebook" Sample No. 16928)	91
	H-Coal	NA	0.8442	PDU, fuel oil mode, atmospheric still overhead	91
		NA	1.031	PDU, fuel oil mode, vacuum still overhead	91
		NA	0.9926	PDU, fuel oil mode, atmospheric still bottoms	91
		NA	1.49*	PDU, fuel oil mode, vacuum still bottoms	91
		NA	1.41*	PDU, syncrude mode, vacuum still bottoms	91

Explanatory Notes

*Helium Pycnometer at 71.6°F

†By water displacement in Hubbarb-Carmick Pycnometer

Table 197. Distillation Data

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	KY No. 9 and 14	400°F-IBP 510°F-50 780°F-EP	Ft. Lewis pilot plant, process solvent	83
		NA	413°F-IBP* 448°F-5 460°F-10 495°F-30 540°F-50 623°F-70† NA-90 NA-95 NA-EP	Wilsonville pilot plant, process solvent	84
		KY No. 9 and 14	266°F-IBP 398°F-50 523°F-EP	Ft. Lewis pilot plant, wash solvent	83
		NA	196°F-IBP* 230°F-5 350°F-10 374°F-30 388°F-50 399°F-70 427°F-90 450°F-95 519°F-EP	Wilsonville pilot plant, wash solvent	84
	EDS	IL No. 6	398°F-5 531°F-50 833°F-95	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99
		IL No. 6	422°F-10 457°F-50 658°F-90	One tpd pilot plant, process solvent	99
		IL No. 6 (Monterey Mine)	390 ± 8°F -5 510 ± 18°F-50 799 ± 41°F-95	One tpd pilot plant, process solvent; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	398 ± 8°F -5 531 ± 16°F-50 833 ± 53°F-95	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99

(Continued)

Table 197 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	IL No. 6 (Monterey Mine)	401 ± 4°F-5 508 ± 22°F-50 744 ± 34°F-95	75 lb per day development unit; process solvent; average of six operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		IL No. 6 (Monterey Mine)	395 ± 2°F-5 505 ± 9°F-50 747 ± 25°F-95	75 lb per day development unit; process solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time, average of 21 yield periods	99
		IL No. 6	374°F-5 514°F-50 797°F-95	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		IL No. 6 (Monterey Mine)	365 ± 12°F-5 495 ± 18°F-50 751 ± 50°F-95	One tpd pilot plant, hydrogenated recycle solvent; average of three operating conditions (840°F reactor temperature, 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	374 ± 20°F-5 514 ± 14°F-50 797 ± 36°F-95	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time, average of ten yield periods	99
		IL No. 6	629°F-5 900°F-50 1030°F-90	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		IL No. 6	370°F-5 700°F-50 960°F-95	One tpd pilot plant, coker gas oil from "typical" run	99
		Wyodak	379°F-5 465°F-50 716°F-95	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99

(Continued)

Table 197 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	Wyodak	388 ± 8°F-5 482 ± 13°F-50 731 ± 37°F-95	One tpd pilot plant, process solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	379 ± 12°F-5 465 ± 12°F-50 716 ± 28°F-95	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	408 ± 48°F-5 509 ± 10°F-50 741 ± 24°F-95	75 lb per day development unit; process solvent; average of eight operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		Wyodak	396 ± 6°F-5 508 ± 6°F-50 726 ± 9°F-95	75 lb per day development unit; process solvent; operating conditions: 880°F reactor temperature, 25 minutes residence time, average of six yield periods	99
		Wyodak	365°F-5 454°F-50 689°F-95	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		Wyodak	365 ± 10°F-5 474 ± 13°F-50 743 ± 43°F-95	One tpd pilot plant, hydrogenated recycle solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	365 ± 4°F-5 454 ± 5°F-50 689 ± 20°F-95	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99

(Continued)

Table 197 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	Wyodak	605°F-5 752°F-50 962°F-95	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		Wyodak	400°F-5 795°F-50 980°F-95	One tpd pilot plant, coker gas oil from "typical" run	99
		Wyodak	499°F-5 672°F-50 908°F-95	One tpd pilot plant, vacuum gas oil; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	473°F-5 655°F-50 893°F-95	One tpd pilot plant, vacuum gas oil; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		NA	194°F-IBP‡ 311°F-5 373°F-10 408°F-30 454°F-50 525°F-70 642°F-90 686°F-95 694°F-EP	One tpd pilot plant, hydrogenated recycle solvent	84
		NA	NA-IBP‡ 409°F-5 419°F-10 453°F-30 499°F-50 538°F-70 584°F-90 602°F-95 608°F-EP	One tpd pilot plant, hydrogenated recycle solvent, reprocessed to remove 650°F+ fraction	84

(Continued)

Table 197 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	139°F-IBP* 214°F-10 288°F-30 352°F-50 404°F-70 446°F-90 521°F-EP	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, atmospheric still overhead§,#	155
		IL No. 6	140°F-IBP* 220°F-10 288°F-30 348°F-50 412°F-70 480°F-90 556°F-EP	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, atmospheric still overhead§,#	155
		IL No. 6	156°F-IBP* 281°F-10 360°F-30 411°F-50 465°F-70 537°F-90 621°F-EP	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, atmospheric still overhead§,#	155
		KY No. 11	144°F-IBP* 239°F-10 317°F-30 390°F-50 436°F-70 502°F-90 594°F-EP	PDU Run 9, Period 6AB, syncrude mode, atmospheric still overhead[††,‡‡]	156
		KY No. 11	148°F-IBP* 231°F-10 310°F-30 374°F-50 417°F-70 480°F-90 536°F-EP	PDU Run 9, Period 12AB, syncrude mode, atmospheric still overhead[††,‡‡]	156
		KY No. 11	141°F-IBP* 227°F-10 307°F-30 368°F-50 410°F-70 465°F-90 541°F-EP	PDU Run 9, Period 18AB, syncrude mode, atmospheric still overhead[††,‡‡]	156

(Continued)

Table 197 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	KY No. 11	144°F-IBP* 220°F-10 304°F-30 368°F-50 414°F-70 465°F-90 565°F-EP	PDU Run 9, Period 28AB, syncrude mode, atmospheric still overhead[††],[‡‡]	156
		KY No. 11	136°F-IBP* 214°F-10 270°F-30 322°F-50 378°F-70 475°F-90 577°F-EP	PDU Run 9, Period 28AB, syncrude mode, atmospheric still overhead[††],[‡‡]	156
		IL No. 6	468°F-IBP‡ 512°F-10 585°F-30 643°F-50 705°F-70 824°F-90 915°F-EP	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, vacuum still overhead§,#	155
		IL No. 6	436°F-IBP‡ 519°F-10 588°F-30 649°F-50 737°F-70 790°F-90 930°F-EP	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, vacuum still overhead§,#	155
		IL No. 6	450°F-IBP‡ 537°F-10 600°F-30 706°F-50 768°F-70 865°F-90 1000°F-EP	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, vacuum still overhead§,#	155
		KY No. 11	451°F-IBP* 549°F-10 626°F-30 705°F-50 765°F-70 877°F-90 975°F-EP	PDU Run 9, Period 6AB, syncrude mode, vacuum still overhead[††],[‡‡]	156
		KY No. 11	467°F-IBP* 557°F-10 631°F-30 705°F-50 755°F-70 865°F-90 940°F-EP	PDU Run 9, Period 12AB, syncrude mode, vacuum still overhead[††],[‡‡]	156

(Continued)

Table 197 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	KY No. 11	432°F-IBP* 537°F-10 606°F-30 660°F-50 730°F-70 836°F-90 920°F-EP	PDU Run 9, Period 18AB, syncrude mode, vacuum still overhead[††,‡‡]	156
		KY No. 11	457°F-IBP* 553°F-10 635°F-30 750°F-50 794°F-70 859°F-90 992°F-EP	PDU Run 9, Period 23AB, syncrude mode, vacuum still overhead[††,‡‡]	156
		KY No. 11	412°F-IBP* 521°F-10 618°F-30 713°F-50 752°F-70 860°F-90 1010°F-EP	PDU Run 9, Period 28AB, syncrude mode, vacuum still overhead[††,‡‡]	156
		IL No. 6	401°F-IBP* 454°F-10 499°F-30 541°F-50 587°F-70 680°F-90 850°F-EP	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, atmospheric still bottoms§,#	155
		IL No. 6	409°F-IBP* 469°F-10 509°F-30 552°F-50 600°F-70 693°F-90 870°F-EP	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, atmospheric still bottoms§,#	155
		IL No. 6	442°F-IBP* 508°F-10 553°F-30 595°F-50 645°F-70 774°F-90 928°F-EP	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, atmospheric still bottoms§,#	155

(Continued)

Table 197 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal liquid inter-mediates	H-Coal	KY No. 11	470°F-IBP* 521°F-10 551°F-30 600°F-50 647°F-70 741°F-90 845°F-EP	PDU Run 9, Period 6AB, syncrude mode, atmospheric still bottoms[††,‡‡]	156
		KY No. 11	467°F-IBP* 521°F-10 560°F-30 600°F-50 649°F-70 750°F-90 842°F-EP	PDU Run 9, Period 12AB, syncrude mode, atmospheric still bottoms[††,‡‡]	156
		KY No. 11	459°F-IBP* 508°F-10 551°F-30 584°F-50 633°F-70 724°F-90 789°F-EP	PDU Run 9, Period 18AB, syncrude mode, atmospheric still bottoms[††,‡‡]	156
		KY No. 11	469°F-IBP* 511°F-10 547°F-30 593°F-50 646°F-70 770°F-90 890°F-EP	PDU Run 9, Period 23AB, syncrude mode, atmospheric still bottoms[††,‡‡]	156
		KY No. 11	388°F-IBP* 452°F-10 510°F-30 566°F-50 629°F-70 772°F-90 910°F-EP	PDU Run 9, Period 28AB, syncrude mode, atmospheric still bottoms[††,‡‡]	156
		NA	386°F-IBP* 429°F-5 439°F-10 502°F-30 559°F-50 620°F-70 734°F-90 746°F-95 746°F-EP	PDU, atmospheric still bottoms	84

(Continued)

Table 197 (Concluded)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	655°F-IBP**	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, vacuum still bottoms§,#	155
		IL No. 6	751°F-IBP**	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, vacuum still bottoms§,#	155
		IL No. 6	714°F-IBP**	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, vacuum still bottoms§,#	155

Explanatory Notes

*Determined via ASTM D-86.

†Distillation terminated due to solids in condenser.

‡Determined via ASTM D-1160.

§See General Comments, Note 2, for summary of operating conditions used.

#Periods 3AB, 11B and 20AB are considered representative periods for the entire PDU Run 8, which consisted of over 32 individual periods.

**Determined via modified ASTM D-1160.

††See General Comments, Note 3, for summary of operating conditions used.

‡‡Periods 6AB, 12AB, 18AB, 23AB and 28AB are considered representative periods of the entire PDU Run 9, which consisted of over 30 individual periods.

Table 198. GC Simulated Distillation Data

Material	Process	Coal Type	Value (Boiling Point Range)	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	NA	392°F-IBP* 411°F-5 444°F-10 472°F-30 509°F-50 588°F-70 674°F-90 730°F-95 899°F-EP	Wilsonville pilot plant, process solvent	84
		NA	188°F-IBP* 301°F-5 336°F-10 377°F-30 401°F-50 416°F-70 449°F-90 458°F-95 565°F-EP	Wilsonville pilot plant, wash solvent	84
	H-Coal	NA	305°F-IBP* 367°F-5 397°F-10 474°F-30 537°F-50 596°F-70 703°F-90 762°F-95 929°F-EP	PDU, atmospheric still bottoms	84

Explanatory Notes

*Determined via ASTM D-2887

Table 199. Viscosity

Material	Process	Coal Type	Value (Centistokes)	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	KY No. 9 and 14	44.0(cp at 100°F)	Ft. Lewis pilot plant, process solvent	83
		NA	6.04(104°F) 1.45(212°F)	Wilsonville pilot plant, recycle solvent	84
		KY No. 9 and 14	2.71(cp at 100°F)	Ft. Lewis pilot plant, wash solvent	83
		NA	1.75(104°F) 0.77(212°F)	Wilsonville pilot plant, wash solvent	84
	EDS	IL No. 6	5.0(100°F) 1.5(210°F)	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99
		IL No. 6	3.6(100°F)	One tpd pilot plant, process solvent	99
		IL No. 6 (Monterey (Mine)	38 (SSU at 100°F)	One tpd pilot plant, process solvent	104
		IL No. 6 (Monterey Mine)	4.17 + 0.75 (100°F) 1.34 + 0.11 (210°F)	One tpd pilot plant, process solvent; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	5.04 + 0.51 (100°F) 1.46 + 0.08 (210°F)	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods.	99
		IL No. 6	3.7(100°F) 1.3(210°F)	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		IL No. 6 (Monterey Mine)	3.09 + 0.55 (100°F) 1.13 + 0.16 (210°F)	One tpd pilot plant, hydrogenated recycle solvent; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99

(Continued)

Table 199 (Continued)

Material	Process	Coal Type	Value (Centistokes)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	IL No. 6 (Monterey Mine)	3.70 ± 0.49 (100°F) 1.28 ± 0.07 (210°F)	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6	18,000 (100°F) 342 (210°F)	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		IL No. 6	393 (100°F) 16 (210°F)	One tpd pilot plant, coker gas oil from "typical" run	99
		IL No. 6	1255 (400°F) 100 (500°F)	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		Wyodak	2.7(100°F) 1.1(210°F)	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99
		Wyodak	4.01 ± 2.69 (100°F) 1.31 ± 0.29 (210°F)	One tpd pilot plant, process solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	2.69 ± 0.32 (100°F) 1.04 ± 0.07 (210°F)	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	2.4(100°F) 1.0(210°F)	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99

(Continued)

Table 199 (Continued)

Material	Process	Coal Type	Value (Centistokes)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	Wyodak	2.71 ± 0.39 (100°F) 1.43 ± 0.86 (210°F)	One tpd pilot plant, hydrogenated recycle solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	2.44 ± 0.19 (100°F) 1.00 ± 0.04 (210°F)	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	483 (210°F) 3 (300°F)	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		Wyodak	10,000 (170°F) 341 (210°F)	One tpd pilot plant, coker gas oil from "typical" run	99
		Wyodak	10,000 (420°F) 30 (550°F)	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		NA	2.67 (104°F) 1.11 (212°F)	One tpd pilot plant, hydrogenated recycle solvent	84
		NA	2.34 (104°F) 1.00 (212°F)	One tpd pilot plant, hydrogenated recycle solvent, reprocessed to remove 650°F+ fraction	84

(Continued)

Table 199 (Continued)

Material	Process	Coal Type	Value (Centistokes)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6 (Burning Star Mine)	38 (SSU at 77°F) 35 (SSU at 100°F)	PDU, fuel oil mode, blend of atmospheric still overhead and vacuum still overhead	97
		IL No. 6 (Monterey Mine)	59 (SSU at 77°F) 46 (SSU at 100°F)	PDU, syncrude mode, blend of atmospheric still overhead and vacuum still overhead	97
		NA	7.13 (104°F) 1.78 (212°F)	PDU, atmospheric still bottoms	84
		IL No. 6	3430.0 (centipoise at 500°F)[‡]	PDU Run 8, Period 11B, vacuum still bottoms, fuel oil mode with high catalyst age[*,†]	155
		KY No. 11	710.0 (centipoise at 500°F)[‡]	PDU Run 9, Period 6AB, syncrude mode, vacuum still bottoms§,#	156
		KY No. 11	480.0 (centipoise at 500°F)[‡]	PDU Run 9, Period 12AB, syncrude mode, vacuum still bottoms§,#	156
		KY No. 11	450.0 (centipoise at 500°F)[‡]	PDU Run 9, Period 18AB, syncrude mode, vacuum still bottoms§,#	156
		KY No. 11	690.0 (centipoise at 500°F)[‡]	PDU Run 9, Period 23AB, syncrude mode, vacuum still bottoms§,#	156
		KY No. 11	500.0 (centipoise at 500°F)[‡]	PDU Run 9, Period 28AB, syncrude mode, vacuum still bottoms§,#	156

(Continued)

Table 199 (Concluded)

Explanatory Notes

*See General Comments, Note 2, for summary of operating conditions used.

†Periods 3AB, 11B and 20AB are considered representative periods for the entire PDU Run 8, which consisted of over 32 individual periods.

‡Average of Brookfield viscosity values at 5-100 RPM.

§See General Comments, Note 3, for summary of operating conditions used.

#Periods 6AB, 12AB, 18AB, 23AB and 28AB are considered representative periods for the entire PDU Run 9, which consisted of over 30 individual periods.

Table 200. Pour Point

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	NA	35.0	Wilsonville pilot plant, process solvent	84
		NA	<-65.0	Wilsonville pilot plant, wash solvent	84
	EDS	IL No. 6 (Monterey Mine)	-5	One tpd pilot plant, process solvent	104
		NA	-36.0	One tpd pilot plant, hydrogenated recycle solvent	84
		NA	-36.0	One tpd pilot plant, hydrogenated recycle solvent, reprocessed to remove 650°F+ fraction	84
	H-Coal	IL No. 6 (Burning Star Mine)	<5	PDU, fuel oil mode, blend of atmospheric still overhead and vacuum still overhead	97
		IL No. 6 (Monterey Mine)	<5	PDU, syncrude mode, blend of atmospheric still overhead and vacuum still overhead	97
		NA	5	PDU, atmospheric still bottoms	84

Table 201. Carbon Residue*,†

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	NA	4.95	Wilsonville pilot plant, process solvent	84
		NA	0.07	Wilsonville pilot plant, wash solvent	84
	EDS	IL No. 6 (Monterey Mine)	3.0	One tpd pilot plant, process solvent	104
		IL No. 6	3.1	One tpd pilot plant, process solvent	99
		NA	0.03	One tpd pilot plant, hydrogenated recycle solvent	84
		NA	0.03	One tpd pilot plant, hydrogenated recycle solvent, reprocessed to remove 650°F+ fraction	84
	H-Coal	NA	0.52	PDU, atmospheric still bottoms	84
		IL. No. 6 (Burning Star Mine)	0.10	PDU, blend of atmospheric still overhead and bottoms	144

Explanatory Notes

*Determined via ASTM D-189
†Conradsen carbon residue

Table 202. Flash Point

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal liquid inter-mediates	SRC-I	NA	235.0	Wilsonville pilot plant, process solvent	84
		NA	95.0	Wilsonville pilot plant, wash solvent	84
	EDS	IL No. 6	158	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99
		IL No. 6	196	One tpd pilot plant, process solvent	99
		IL No. 6	196	One tpd pilot plant, process solvent	104
		IL No. 6	80	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		IL No. 6	>415	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		IL No. 6	>415	One tpd pilot plant, coker gas oil from "typical" run	99
		IL No. 6	>415	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		Wyodak	198	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99
		Wyodak	80	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		Wyodak	>415	One td pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		Wyodak	>415	One tpd pilot plant, coker gas oil from "typical" run	99

(Continued)

Table 202 (Concluded)

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal liquid intermediate	EDS	Wyodak	>415	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		NA	101.0	One tpd pilot plant, hydrogenated recycle solvent	84
		NA	122.0	One tpd pilot plant, hydrogenated recycle solvent, reprocessed to remove 650°F+ fraction	84
	H-Coal	NA	203	PDU, atmospheric still bottoms	84

Table 203. Heat of Combustion

Material	Process	Coal Type	Value (Btu/lb)	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	NA	17,299 (gross)	Wilsonville pilot plant, recycle solvent	84
		NA	17,050 (gross)	Wilsonville pilot plant, wash solvent	84
	EDS	IL No. 6	18,500	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99
		IL No. 6 (Monterey Mine)	19,000	One tpd pilot plant, process solvent	99
		IL No. 6	19,000	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		IL No. 6	16,400	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		IL No. 6	17,200	One tpd pilot plant, coker gas oil from "typical" run	99
		IL No. 6	16,100	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		Wyodak	18,700	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99
		Wyodak	19,000	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		Wyodak	17,300	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		Wyodak	16,800	One tpd pilot plant, coker gas oil from "typical" run	99

(Continued)

Table 203 (Concluded)

Material	Process	Coal Type	Value (Btu/lb)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	Wyodak	16,000	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		NA	18,343 (gross)	One tpd pilot plant, hydrogenated recycle solvent	84
		NA	18,400 (gross)	One tpd pilot plant, hydrogenated recycle solvent, reprocessed to remove 650°F+ fraction	84
	H-Coal	NA	17,662 (gross)	PDU, atmospheric still bottoms	84

Table 204. Heat Capacity

Material	Process	Coal Type	Value (Btu/lb/°F)	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	KY No. 9 and 14	0.430 (100°F) 0.554 (400°F)	Ft. Lewis pilot plant, process solvent	83
		KY No. 9 and 14	0.468 (100°F)	Ft. Lewis pilot plant, wash solvent	83

Table 205. Bromine Number

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal liquid intermediates	EDS	IL No. 6	13.9	One tpd pilot plant, process solvent	99
	H-Coal (Burning Star Mine)	IL No. 6	41.7	PDU, blend of atmospheric still overhead and bottoms	144

Table 206. Color

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	brownish black	PDU, fuel oil mode, blend of atmospheric still overhead and vacuum still overhead	97
		IL No. 6	brownish black	PDU, syncrude mode, blend of atmospheric still overhead and vacuum still overhead	97

Table 207. Oxygen Content

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid inter-mediates	SRC-I	KY No. 9 and 14	2.39	Ft Lewis pilot plant, process solvent	83
		KY No. 9 and 14	5.77	Ft. Lewis pilot plant, wash solvent	83
		NA	2.2	Wilsonville pilot plant, process solvent	84
		NA	2.8	Wilsonville pilot plant, process solvent	119
		NA	5.7*	Wilsonville pilot plant, wash solvent	84
	EDS	IL No. 6	1.31	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99
		IL No. 6 (Monterey Mine)	1.12 ± 0.17	One tpd pilot plant, process solvent; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	1.31 ± 0.24	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6 (Monterey Mine)	0.29 ± 0.04	75 lb per day development unit, process solvent; average of six operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		IL No. 6 (Monterey Mine)	0.30 ± 0.07	75 lb per day development unit, process solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time, average of 21 yield periods	99

(Continued)

Table 207 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	IL No. 6	0.43	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		IL No. 6 (Monterey Mine)	0.27 ± 0.15	One tpd pilot plant, hydrogenated recycle solvent; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	0.43 ± 0.32	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6	3.83	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		IL No. 6 (Monterey Mine)	4.36 ± 0.47	One tpd pilot plant, vacuum gas oil; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	3.83 ± 0.33	One tpd pilot plant, vacuum gas oil; operating conditions: 840°F reactor temperature; 40 minutes residence time; average of ten yield periods	99
		IL No. 6	4.5	One tpd pilot plant, coker gas oil from "typical" run	99
		IL No. 6	4.5	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		Wyodak	1.14	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99

(Continued)

Table 207 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	Wyodak	0.93 ± 0.34	One tpd pilot plant, process solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	1.14 ± 0.32	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	0.22 ± 0.17	75 lb per day development unit; process solvent; average of eight operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		Wyodak	0.20 ± 0.09	75 lb per day development unit; process solvent; operating conditions: 880°F reactor temperature, 25 minutes residence time, average of six yield periods	99
		Wyodak	0.38	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		Wyodak	0.19 ± 0.20	One tpd pilot plant, hydrogenated recycle solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	0.38 ± 0.27	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99

(Continued)

Table 207 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	Wyodak	2.52	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		Wyodak	3.06 ± 0.94	One tpd pilot plant, vacuum gas oil; average of six operating conditions (800-840°F reactor temperature; 40-100 minutes residence time)	99
		Wyodak	2.52 ± 0.63	One tpd pilot plant, vacuum gas oil; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	2.43	One tpd pilot plant, coker gas oil from "typical" run	99
		Wyodak	3.39	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		NA	0.33	One tpd pilot plant, hydrogenated recycle solvent	84
		NA	0.48	One tpd pilot plant, hydrogenated recycle solvent, reprocessed to remove 650°F+ fraction	84
		NA	1.04	One tpd pilot plant, process solvent (DuPont "Notebook" Sample No. 16928)	91
		NA	3.46	One tpd pilot plant, vacuum gas oil (DuPont "Notebook" Sample No. 16928)	91
		NA	3.18	One tpd pilot plant, heavy gas oil (DuPont "Notebook" Sample No. 16928)	91

(Continued)

Table 207 (Concluded)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	NA	1.45	PDU, fuel oil mode, atmospheric still overhead	91
		NA	1.40	PDU, fuel oil mode, vacuum still overhead	91
		NA	1.54	PDU, fuel oil mode, atmospheric still bottoms	91
		NA	10.84	PDU, fuel oil mode, vacuum still bottoms	91
		NA	12.91	PDU, syncrude mode, vacuum still bottoms	91
		IL No. 6 (Burning Star Mine)	1.72	PDU, blend of atmospheric still overhead and bottoms	144
		NA	1.79	PDU, atmospheric still bottoms	84

Explanatory Notes

*Contains 1.61 wt % miscible water

Table 208. Sulfur Content

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	KY No. 9 and 14	0.46	Ft. Lewis pilot plant, process solvent	83
		KY No. 9 and 14	0.22	Ft. Lewis pilot plant, wash solvent	83
		NA	0.30	Wilsonville pilot plant, process solvent	84
		NA	0.49	Wilsonville pilot plant, process solvent	119
		NA	0.26	Wilsonville pilot plant, wash solvent	84
	EDS	IL No. 6	0.22	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99
		IL No. 6	0.2860	One tpd pilot plant, process solvent	99
		IL No. 6	0.3000	One tpd pilot plant, process solvent	104
		IL No. 6 (Monterey Mine)	0.33 ± 0.16	One tpd pilot plant, process solvent; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	0.22 ± 0.03	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6 (Monterey Mine)	0.01 ± 0.00	75 lb per day development unit, process solvent; average of six operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		IL No. 6 (Monterey Mine)	0.01 ± 0.00	75 lb per day development unit, process solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time, average of 21 yield periods	99

(Continued)

Table 208 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	IL No. 6	0.01	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		IL No. 6 (Monterey Mine)	0.05 ± 0.04	One tpd pilot plant, hydrogenated recycle solvent; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	0.01 ± 0.00	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6	0.95	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		IL No. 6 (Monterey Mine)	1.12 ± 0.16	One tpd pilot plant, vacuum gas oil; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	0.95 ± 0.08	One tpd pilot plant, vacuum gas oil; operating conditions: 840°F reactor temperature; 40 minutes residence time; average of ten yield periods	99
		IL No. 6	1.0	One tpd pilot plant, coker gas oil from "typical" run	99
		IL No. 6	1.3	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		Wyodak	0.01	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99

(Continued)

Table 208 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid inter-mediates	EDS	Wyodak	0.02 ± 0.01	One tpd pilot plant, process solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	0.01 ± 0.00	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	0.00 ± 0.00	75 lb per day development unit; process solvent; average of eight operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		Wyodak	0.00 ± 0.00	75 lb per day development unit; process solvent; operating conditions: 880°F reactor temperature, 25 minutes residence time, average of six yield periods	99
		Wyodak	0.00	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		Wyodak	0.01 ± 0.01	One tpd pilot plant, hydrogenated recycle solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	0.00 ± 0.00	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99

(Continued)

Table 208 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	Wyodak	0.05	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		Wyodak	0.08 ± 0.03	One tpd pilot plant, vacuum gas oil; average of six operating conditions (800-840°F reactor temperature; 40-100 minutes residence time)	99
		Wyodak	0.05 ± 0.01	One tpd pilot plant, vacuum gas oil; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	0.09	One tpd pilot plant, coker gas oil from "typical" run	99
		Wyodak	0.14	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		NA	0.03	One tpd pilot plant, hydrogenated recycle solvent	84
		NA	0.02	One tpd pilot plant, hydrogenated recycle solvent, reprocessed to remove 650°F+ fraction	84
		NA	0.23	One tpd pilot plant, process solvent (DuPont "Notebook" Sample No. 16928)	91
		NA	1.26	One tpd pilot plant, vacuum gas oil (DuPont "Notebook" Sample No. 16928)	91
		NA	0.64	One tpd pilot plant, heavy gas oil (DuPont "Notebook" Sample No. 16928)	91

(Continued)

Table 208 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	0.13*	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, atmospheric still overhead[†],[‡]	155
		IL No. 6	0.29*	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, atmospheric still overhead[†],[‡]	155
		IL No. 6	0.26*	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, atmospheric still overhead[†],[‡]	155
		KY No. 11	<0.03*	PDU Run 9, Period 6AB, syncrude mode, atmospheric still overhead§,#	156
		KY No. 11	0.12*	PDU Run 9, Period 12AB, syncrude mode, atmospheric still overhead§,#	156
		KY No. 11	0.18*	PDU Run 9, Period 18AB, syncrude mode, atmospheric still overhead§,#	156
		KY No. 11	0.17*	PDU Run 9, Period 23AB, syncrude mode, atmospheric still overhead§,#	156
		KY No. 11	0.15*	PDU Run 9, Period 28AB, syncrude mode, atmospheric still overhead§,#	156
		IL No. 6	0.07	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, vacuum still overhead[†],[‡]	155
		IL No. 6	0.17	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, vacuum still overhead[†],[‡]	155

(Continued)

Table 208 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	0.16	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, vacuum still overhead†,‡	155
		KY No. 11	<0.03	PDU Run 9, Period 6AB, syncrude mode, vacuum still overhead§,#	156
		KY No. 11	0.05	PDU Run 9, Period 12AB, syncrude mode, vacuum still overhead§,#	156
		KY No. 11	0.11	PDU Run 9, Period 18AB, syncrude mode, vacuum still overhead§,#	156
		KY No. 11	0.17	PDU Run 9, Period 23AB, syncrude mode, vacuum still overhead§,#	156
		KY No. 11	0.13	PDU Run 9, Period 28AB, syncrude mode, vacuum still overhead§,#	156
		IL No. 6	<0.03	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, atmospheric still bottoms†,‡	155
		IL No. 6	0.10	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, atmospheric still bottoms†,‡	155
		IL No. 6	0.14	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, atmospheric still bottoms†,‡	155
		KY No. 11	<0.03	PDU Run 9, Period 6AB, syncrude mode, atmospheric still bottoms§,#	156
		KY No. 11	<0.03	PDU Run 9, Period 12AB, syncrude mode, atmospheric still bottoms§,#	156

(Continued)

Table 208 (Continued)

Material	Process	Coal Type	Value (Wt %O)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	KY No. 11	0.04	PDU Run 9, Period 18AB, syncrude mode, atmospheric still bottoms§,#	156
		KY No. 11	0.11	PDU Run 9, Period 23AB, syncrude mode, atmospheric still bottoms§,#	156
		KY No. 11	0.08	PDU Run 9, Period 28AB, syncrude mode, atmospheric still bottoms§,#	156
		IL No. 6	2.22	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, vacuum still bottoms†,‡	155
		IL No. 6	2.22	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, vacuum still bottoms†,‡	155
		IL No. 6	1.99	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, vacuum still bottoms†,‡	155
		KY No. 11	3.00	PDU Run 9, Period 6AB, syncrude mode, vacuum still bottoms§,#	156
		KY No. 11	2.73	PDU Run 9, Period 12AB, syncrude mode, vacuum still bottoms§,#	156
		KY No. 11	2.75	PDU Run 9, Period 18AB, syncrude mode, vacuum still bottoms§,#	156
		KY No. 11	2.44	PDU Run 9, Period 23AB, syncrude mode, vacuum still bottoms§,#	156
		KY No. 11	2.86	PDU Run 9, Period 28AB, syncrude mode, vacuum still bottoms§,#	156

(Continued)

Table 208 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid inter-mediates	H-Coal	NA	0.41	PDU, fuel oil mode, atmospheric still overhead	91
		NA	0.15	PDU, fuel oil mode, vacuum still overhead	91
		NA	0.12	PDU, fuel oil mode, atmospheric still bottoms	91
		NA	1.81	PDU, fuel oil mode, vacuum still bottoms	91
		NA	2.23	PDU, syncrude mode, vacuum still bottoms	91
		IL No. 6 (Burning Star Mine)	0.15	PDU, blend of atmospheric still overhead and bottoms	144
		NA	0.14	PDU, atmospheric still bottoms	84
		IL. No. 6	0.21	PDU, syncrude mode, blend of atmospheric still overhead and vacuum still overhead	97
		IL. No. 6	0.27	PDU, fuel oil mode, blend of atmospheric still overhead and vacuum still overhead	97
		IL No. 6	0.07	PDU, syncrude mode, atmospheric still overhead, DOE Sample No. 1308	151
		IL No. 6	<0.03	PDU, syncrude mode, atmospheric still bottoms, DOE Sample No. 1309	151
		IL No. 6	<0.03	PDU, syncrude mode, vacuum still overhead, DOE Sample No. 1310	151
		IL No. 6	3.0	PDU, syncrude mode, vacuum still bottoms, DOE Sample No. 1311	151

(Continued)

Table 208 (Concluded)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid inter-mediates	H-Coal	IL. No. 6	0.2	PDU, fuel oil mode, atmospheric still overhead, DOE Sample No. 1312	151
		IL. No 6	0.5	PDU, fuel oil mode, atmospheric still bottoms, DOE Sample No. 1313	151
		IL No. 6	0.1	PDU, fuel oil mode, vacuum still overhead, DOE Sample No. 1314	151
		IL. No. 6	2.2	PDU, fuel oil mode, vacuum still bottoms, DOE Sample No. 1315	151

Explanatory Notes:

*H_2S free

†See General Comments section, Note 2, for summary of operating conditions used.

‡Periods 3AB, 11B and 20AB are considered representative periods for the entire PDU Run 8, which consisted of over 32 individual periods.

§See General Comments section, Note 3, for summary of operating conditions used.

#Periods 6AB, 12AB, 18AB, 23AB and 28AB are considered representative periods for the entire PDU Run 9, which consisted of over 30 individual periods.

Table 209. Nitrogen Content

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	KY No. 9 and 14	0.94	Ft. Lewis pilot plant, process solvent	83
		KY No. 9 and 14	0.55	Ft. Lewis pilot plant, wash solvent	83
		NA	0.69	Wilsonville pilot plant, process solvent	84
		NA	1.0	Wilsonville pilot plant, process solvent	119
		NA	0.35	Wilsonville pilot plant, wash solvent	84
	EDS	IL No. 6	0.30	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99
		IL No. 6	0.30	One tpd pilot plant, process solvent	99
		IL No. 6 (Monterey Mine)	0.20	One tpd pilot plant, process solvent	104
		IL No. 6 (Monterey Mine)	0.24 ± 0.05	One tpd pilot plant, process solvent; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	0.30 ± 0.04	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6 (Monterey Mine)	0.05 ± 0.01	75 lb per day development unit, process solvent; average of six operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		IL No. 6 (Monterey Mine)	0.04 ± 0.01	75 lb per day development unit, process solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time, average of 21 yield periods	99

(Continued)

Table 209 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid inter-mediates	EDS	IL No. 6	0.18	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		IL No. 6 (Monterey Mine)	0.11 ± 0.06	One tpd pilot plant, hydrogenated recycle solvent; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	0.18 ± 0.08	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6	1.38	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		IL No. 6 (Monterey Mine)	1.23 ± 0.13	One tpd pilot plant, vacuum gas oil; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	1.38 ± 0.15	One tpd pilot plant, vacuum gas oil; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6	1.1	One tpd pilot plant, coker gas oil from "typical" run	99
		IL No. 6	1.7	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		Wyodak	0.12	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99

(Continued)

Table 209 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	Wyodak	0.15 ± 0.02	One tpd pilot plant, process solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	0.12 ± 0.05	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	0.12 ± 0.12	75 lb per day development unit; process solvent; average of eight operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		Wyodak	0.19 ± 0.03	75 lb per day development unit; process solvent; operating conditions: 880°F reactor temperature, 25 minutes residence time, average of six yield periods	99
		Wyodak	0.07	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		Wyodak	0.07 ± 0.02	One tpd pilot plant, hydrogenated recycle solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	0.07 ± 0.02	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99

(Continued)

Table 209 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	Wyodak	0.69	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		Wyodak	0.76 ± 0.19	One tpd pilot plant, vacuum gas oil; average of six operating conditions (800-840°F reactor temperature; 40-100 minutes residence time)	99
		Wyodak	0.69 ± 0.22	One tpd pilot plant, vacuum gas oil; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	0.72	One tpd pilot plant, coker gas oil from "typical" run	99
		Wyodak	1.22	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		NA	0.08	One tpd pilot plant, hydrogenated recycle solvent	84
		NA	0.044	One tpd pilot plant, hydrogenated recycle solvent, reprocessed to remove 650°F+ fraction	84
		NA	0.45	One tpd pilot plant, process solvent (DuPont "Notebook" Sample No. 16928)	91
		NA	1.17	One tpd pilot plant, vacuum gas oil (DuPont "Notebook" Sample No. 16928)	91
		NA	1.06	One tpd pilot plant, heavy gas oil (DuPont "Notebook" Sample No. 16928)	91

(Continued)

Table 209 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	0.24	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, atmospheric still overhead[*],[†]	155
		IL No. 6	0.28	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, atmospheric still overhead[*],[†]	155
		IL No. 6	0.38	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, atmospheric still overhead	155
		KY No. 11	0.31	PDU Run 9, Period 6AB, syncrude mode, atmospheric still overhead[‡],[§]	156
		KY No. 11	0.36	PDU Run 9, Period 12AB, syncrude mode, atmospheric still overhead[‡],[§]	156
		KY No. 11	0.33	PDU Run 9, Period 18AB, syncrude mode, atmospheric still overhead[‡],[§]	156
		KY No. 11	0.42	PDU Run 9, Period 23AB, syncrude mode, atmospheric still overhead[‡],[§]	156
		KY No. 11	0.28	PDU Run 9, Period 28AB, syncrude mode, atmospheric still overhead[‡],[§]	156
		IL No. 6	0.93	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, vacuum still overhead[*],[†]	155
		IL No. 6	0.71	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, vacuum still overhead[*],[†]	155

(Continued)

Table 209 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	0.62	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, vacuum still overhead[*,†]	155
		KY No. 11	0.63	PDU Run 9, Period 6AB, syncrude mode, vacuum still overhead[‡,§]	156
		KY No. 11	0.75	PDU Run 9, Period 12AB, syncrude mode, vacuum still overhead[‡,§]	156
		KY No. 11	0.69	PDU Run 9, Period 18AB, syncrude mode, vacuum still overhead[‡,§]	156
		KY No. 11	0.75	PDU Run 9, Period 23AB, syncrude mode, vacuum still overhead[‡,§]	156
		KY No. 11	0.96	PDU Run 9, Period 28AB, syncrude mode, vacuum still overhead[‡,§]	156
		IL No. 6	0.40	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, atmospheric still bottoms[*,†]	155
		IL No. 6	0.55	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, atmospheric still bottoms[*,†]	155
		IL No. 6	0.57	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, atmospheric still bottoms[*,†]	155
		KY No. 11	0.53	PDU Run 9, Period 6AB, syncrude mode, atmospheric still bottoms[‡,§]	156
		KY No. 11	0.47	PDU Run 9, Period 12AB, syncrude mode, atmospheric still bottoms[‡,§]	156

(Continued)

Table 209 (Continued)

Material	Process	Coal Type	Value (Wt %O)	Sample Description/Source	Reference
Coal liquid inter-mediates	H-Coal	KY No. 11	0.48	PDU Run 9, Period 18AB, syncrude mode, atmospheric still bottoms‡,§	156
		KY No. 11	0.69	PDU Run 9, Period 23AB, syncrude mode, atmospheric still bottoms‡,§	156
		KY No. 11	0.71	PDU Run 9, Period 28AB, syncrude mode, atmospheric still bottoms‡,§	156
		IL No. 6	1.32	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, vacuum still bottoms*,†	155
		IL No. 6	1.65	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, vacuum still bottoms*,†	155
		IL No. 6	1.50	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, vacuum still bottoms*,†	155
		KY No. 11	1.21	PDU Run 9, Period 6AB, syncrude mode, vacuum still bottoms‡,§	156
		KY No. 11	1.28	PDU Run 9, Period 12AB, syncrude mode, vacuum still bottoms‡,§	156
		KY No. 11	1.51	PDU Run 9, Period 18AB, syncrude mode, vacuum still bottoms‡,§	156
		KY No. 11	1.47	PDU Run 9, Period 23AB, syncrude mode, vacuum still bottoms‡,§	156
		KY No. 11	1.48	PDU Run 9, Period 28AB, syncrude mode, vacuum still bottoms‡,§	156

(Continued)

Table 209 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid inter-mediates	H-Coal	NA	0.86	PDU, fuel oil mode, atmospheric still overhead	91
		NA	0.69	PDU, fuel oil mode, vacuum still overhead	91
		NA	0.78	PDU, fuel oil mode, atmospheric still bottoms	91
		NA	1.28	PDU, fuel oil mode, vacuum still bottoms	91
		NA	1.25	PDU, syncrude mode, vacuum still bottoms	91
		IL No. 6 (Burning Star Mine)	0.37	PDU, blend of atmospheric still overhead and bottoms	144
		NA	0.61	PDU, atmospheric still bottoms	84
		IL. No. 6	0.440	PDU, syncrude mode, blend of atmospheric still overhead and vacuum still overhead	97
		IL. No. 6	0.633	PDU, fuel oil mode, blend of atmospheric still overhead and vacuum still overhead	97
		IL No. 6	0.17	PDU, syncrude mode, atmospheric still overhead, DOE Sample No. 1308	151
		IL No. 6	0.37	PDU, syncrude mode, atmospheric still bottoms, DOE Sample No. 1309	151
		IL No. 6	0.42	PDU, syncrude mode, vacuum still overhead, DOE Sample No. 1310	151
		IL No. 6	0.90	PDU, syncrude mode, vacuum still bottoms, DOE Sample No. 1311	151

(Continued)

Table 209 (Concluded)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	0.30	PDU, fuel oil mode, atmospheric still overhead, DOE Sample No. 1312	151
		IL No. 6	0.40	PDU, fuel oil mode, atmospheric still bottoms, DOE Sample No. 1313	151
		IL No. 6	0.50	PDU, fuel oil mode, vacuum still overhead, DOE Sample No. 1314	151
		IL No. 6	1.5	PDU, fuel oil mode, vacuum still bottoms, DOE Sample No. 1315	151

Explanatory Notes:

*See General Comments section, Note 2, for summary of operating conditions used.

†Periods 3AB, 11B and 20AB are considered representative periods for the entire PDU Run 8, which consisted of over 32 individual periods.

‡See General Comments section, Note 3, for summary of operating conditions used.

§Periods 6AB, 12AB, 18AB, 23AB and 28AB are considered representative periods for the entire PDU Run 9, which consisted of over 30 individual periods.

Table 210. Carbon Content

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	KY No. 9 and 14	88.93	Ft. Lewis pilot plant, process solvent	83
		KY No. 9 and 14	84.81	Ft. Lewis pilot plant, wash solvent	83
	EDS	IL No. 6	88.71	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99
		IL No. 6 (Monterey Mine)	88.36 ± 0.35	One tpd pilot plant, process solvent; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	88.71 ± 0.18	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6 (Monterey Mine)	89.93 ± 0.62	75 lb per day development unit, process solvent; average of six operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		IL No. 6 (Monterey Mine)	89.49 ± 0.15	75 lb per day development unit, process solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time, average of 21 yield periods	99
		IL No. 6	89.24	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99

(Continued)

Table 210 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	IL No. 6 (Monterey Mine)	89.52 ± 0.16	One tpd pilot plant, hydrogenated recycle solvent; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	89.24 ± 0.23	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6	86.9	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		IL No. 6 (Monterey Mine)	85.94 ± 0.72	One tpd pilot plant, vacuum gas oil; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	86.95 ± 0.49	One tpd pilot plant, vacuum gas oil; operating conditions: 840°F reactor temperature; 40 minutes residence time; average of ten yield periods	99
		IL No. 6	86.0	One tpd pilot plant, coker gas oil from "typical" run	99
		IL No. 6	86.7	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		Wyodak	89.26	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99

(Continued)

Table 210 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid inter-mediates	EDS	Wyodak	89.68 ± 0.40	One tpd pilot plant, process solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	89.26 ± 0.15	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	90.24 ± 1.12	75 lb per day development unit; process solvent; average of eight operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		Wyodak	90.46 ± 0.13	75 lb per day development unit; process solvent; operating conditions: 880°F reactor temperature, 25 minutes residence time, average of six yield periods	99
		Wyodak	89.47	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		Wyodak	89.61 ± 0.30	One tpd pilot plant, hydrogenated recycle solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99

(Continued)

Table 210 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	Wyodak	89.47 ± 0.17	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	89.28	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		Wyodak	88.40 ± 1.46	One tpd pilot plant, vacuum gas oil; average of six operating conditions (800-840°F reactor temperature; 40-100 minutes residence time)	99
		Wyodak	89.28 ± 0.94	One tpd pilot plant, vacuum gas oil; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	90.13	One tpd pilot plant, coker gas oil from "typical" run	99
		Wyodak	89.68	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		NA	88.58	One tpd pilot plant, process solvent (DuPont "Notebook" Sample No. 16928)	91
		NA	85.90	One tpd pilot plant, vacuum gas oil (DuPont "Notebook" Sample No. 16928)	91
		NA	87.49	One tpd pilot plant, heavy gas oil (DuPont "Notebook" Sample No. 16928)	91

(Continued)

Table 210 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	87.56	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, atmospheric still overhead[*,†]	155
		IL No. 6	85.70	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, atmospheric still overhead[*,†]	155
		IL No. 6	86.66	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, atmospheric still overhead[*,†]	155
		KY No. 11	85.35	PDU Run 9, Period 6AB, syncrude mode, atmospheric still overhead[‡,§]	156
		KY No. 11	84.05	PDU Run 9, Period 12AB, syncrude mode, atmospheric still overhead[‡,§]	156
		KY No. 11	85.60	PDU Run 9, Period 18AB, syncrude mode, atmospheric still overhead[‡,§]	156
		KY No. 11	87.33	PDU Run 9, Period 23AB, syncrude mode, atmospheric still overhead[‡,§]	156
		KY No. 11	86.92	PDU Run 9, Period 28AB, syncrude mode, atmospheric still overhead[‡,§]	156
		IL No. 6	89.65	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, vacuum still overhead[*,†]	155
		IL No. 6	89.07	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, vacuum still overhead[*,†]	155

(Continued)

Table 210 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	89.37	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, vacuum still overhead*,†	155
		KY No. 11	88.51	PDU Run 9, Period 6AB, syncrude mode, vacuum still overhead‡,§	156
		KY No. 11	89.26	PDU Run 9, Period 12AB, syncrude mode, vacuum still overhead‡,§	156
		KY No. 11	89.21	PDU Run 9, Period 18AB, syncrude mode, vacuum still overhead‡,§	156
		KY No. 11	89.33	PDU Run 9, Period 23AB, syncrude mode, vacuum still overhead‡,§	156
		KY No. 11	88.38	PDU Run 9, Period 28AB, syncrude mode, vacuum still overhead‡,§	156
		IL No. 6	89.86	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, atmospheric still bottoms*,†	155
		IL No. 6	88.41	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, atmospheric still bottoms*,†	155
		IL No. 6	88.92	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, atmospheric still bottoms*,†	155
		KY No. 11	88.73	PDU Run 9, Period 6AB, syncrude mode, atmospheric still bottoms‡,§	156
		KY No. 11	88.51	PDU Run 9, Period 12AB, syncrude mode, atmospheric still bottoms‡,§	156

(Continued)

Table 210 (Continued)

Material	Process	Coal Type	Value (Wt %O)	Sample Description/Source	Reference
Coal liquid inter-mediates	H-Coal	KY No. 11	88.74	PDU Run 9, Period 18AB, syncrude mode, atmospheric still bottoms[‡,§]	156
		KY No. 11	88.71	PDU Run 9, Period 23AB, syncrude mode, atmospheric still bottoms[‡,§]	156
		KY No. 11	88.16	PDU Run 9, Period 28AB, syncrude mode, atmospheric still bottoms[‡,§]	156
		IL No. 6	70.16	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, vacuum still bottoms[*,†]	155
		IL No. 6	70.00	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, vacuum still bottoms[*,†]	155
		IL No. 6	70.42	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, vacuum still bottoms[*,†]	155
		KY No. 11	64.30	PDU Run 9, Period 6AB, syncrude mode, vacuum still bottoms[‡,§]	156
		KY No. 11	68.03	PDU Run 9, Period 12AB, syncrude mode, vacuum still bottoms[‡,§]	156
		KY No. 11	71.54	PDU Run 9, Period 18AB, syncrude mode, vacuum still bottoms[‡,§]	156
		KY No. 11	73.32	PDU Run 9, Period 23AB, syncrude mode, vacuum still bottoms[‡,§]	156
		KY No. 11	70.80	PDU Run 9, Period 28AB, syncrude mode, vacuum still bottoms[‡,§]	156

(Continued)

Table 210 (Concluded)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	NA	85.58	PDU, fuel oil mode, atmospheric still overhead	91
		NA	88.88	PDU, fuel oil mode, vacuum still overhead	91
		NA	88.58	PDU, fuel oil mode, atmospheric still bottoms	91
		NA	70.89	PDU, fuel oil mode, vacuum still bottoms	91
		NA	66.24	PDU, syncrude mode, vacuum still bottoms	91
		IL No. 6 (Burning Star Mine)	86.7	PDU, blend of atmospheric still overhead and bottoms	144

Explanatory Notes:

*See General Comments section, Note 2, for summary of operating conditions used.

†Periods 3AB, 11B and 20AB are considered representative periods for the entire PDU Run 8, which consisted of over 32 individual periods.

‡See General Comments section, Note 3, for summary of operating conditions used.

§Periods 6AB, 12AB, 18AB, 23AB and 28AB are considered representative periods for the entire PDU Run 9, which consisted of over 30 individual periods.

Table 211. Hydrogen Content

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	KY No. 9 and 14	7.28	Ft. Lewis pilot plant, process solvent	83
		KY No. 9 and 14	8.65	Ft. Lewis pilot plant, wash solvent	83
		NA	7.74	Wilsonville pilot plant, process solvent	84
		NA	7.65	Wilsonville pilot plant, process solvent	119
		NA	9.23	Wilsonville pilot plant, wash solvent	84
	EDS	IL No. 6	9.46	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99
		IL No. 6 (Monterey Mine)	10.0	One tpd pilot plant, process solvent	104
		IL No. 6 (Monterey Mine)	9.95 ± 0.52	One tpd pilot plant, process solvent; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	9.46 ± 0.21	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6 (Monterey Mine)	9.72 ± 0.34	75 lb per day development unit, process solvent; average of six operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		IL No. 6 (Monterey Mine)	10.16 ± 0.16	75 lb per day development unit, process solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time, average of 21 yield periods	99

(Continued)

Table 211 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	IL No. 6	10.14	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		IL No. 6 (Monterey Mine)	10.05 ± 0.80	One tpd pilot plant, hydrogenated recycle solvent; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	10.14 ± 0.32	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6	6.74	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		IL No. 6 (Monterey Mine)	7.22 ± 0.45	One tpd pilot plant, vacuum gas oil; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	6.74 ± 0.17	One tpd pilot plant, vacuum gas oil; operating conditions: 840°F reactor temperature; 40 minutes residence time; average of ten yield periods	99
		IL No. 6	7.4	One tpd pilot plant, coker gas oil from "typical" run	99
		IL No. 6	5.8	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		Wyodak	9.47	One tpd pilot plant, process solvent from "typical" run (Run A-5)	99

(Continued)

Table 211 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	Wyodak	9.22 ± 0.32	One tpd pilot plant, process solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	9.47 ± 0.31	One tpd pilot plant, process solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	9.42 ± 0.37	75 lb per day development unit; process solvent; average of eight operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		Wyodak	9.15 ± 0.18	75 lb per day development unit; process solvent; operating conditions: 880°F reactor temperature, 25 minutes residence time, average of six yield periods	99
		Wyodak	10.08	One tpd pilot plant, hydrogenated recycle solvent from "typical" run (Run A-6)	99
		Wyodak	10.12 ± 0.37	One tpd pilot plant, hydrogenated recycle solvent; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	10.08 ± 0.23	One tpd pilot plant, hydrogenated recycle solvent; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99

(Continued)

Table 211 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	Wyodak	7.45	One tpd pilot plant, vacuum gas oil from "typical" run (Run A-2)	99
		Wyodak	7.65 ± 0.52	One tpd pilot plant, vacuum gas oil; average of six operating conditions (800-840°F reactor temperature; 40-100 minutes residence time)	99
		Wyodak	7.45 ± 0.41	One tpd pilot plant, vacuum gas oil; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	6.63	One tpd pilot plant, coker gas oil from "typical" run	99
		Wyodak	5.57	One tpd pilot plant, coker scrubber liquids from "typical" run	99
		NA	9.95	One tpd pilot plant, hydrogenated recycle solvent	84
		NA	10.16	One tpd pilot plant, hydrogenated recycle solvent, reprocessed to remove 650°F+ fraction	84
		NA	9.17	One tpd pilot plant, process solvent (DuPont "Notebook" Sample No. 16928)	91
		NA	6.52	One tpd pilot plant, vacuum gas oil (DuPont "Notebook" Sample No. 16928)	91
		NA	7.21	One tpd pilot plant, heavy gas oil (DuPont "Notebook" Sample No. 16928)	91

(Continued)

Table 211 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	11.73	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, atmospheric still overhead[*,†]	155
		IL No. 6	11.42	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, atmospheric still overhead[*,†]	155
		IL No. 6	11.07	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, atmospheric still overhead[*,†]	155
		KY No. 11	11.64	PDU Run 9, Period 6AB, syncrude mode, atmospheric still overhead[‡,§]	156
		KY No. 11	11.67	PDU Run 9, Period 12AB, syncrude mode, atmospheric still overhead[‡,§]	156
		KY No. 11	11.57	PDU Run 9, Period 18AB, syncrude mode, atmospheric still overhead[‡,§]	156
		KY No. 11	12.06	PDU Run 9, Period 23AB, syncrude mode, atmospheric still overhead[‡,§]	156
		KY No. 11	12.25	PDU Run 9, Period 28AB, syncrude mode, atmospheric still overhead[‡,§]	156
		IL No. 6	8.25	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, vacuum still overhead[*,†]	155
		IL No. 6	7.96	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, vacuum still overhead[*,†]	155

(Continued)

Table 211 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	8.60	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, vacuum still overhead[*,†]	155
		KY No. 11	8.36	PDU Run 9, Period 6AB, syncrude mode, vacuum still overhead[‡,§]	156
		KY No. 11	8.22	PDU Run 9, Period 12AB, syncrude mode, vacuum still overhead[‡,§]	156
		KY No. 11	8.08	PDU Run 9, Period 18AB, syncrude mode, vacuum still overhead[‡,§]	156
		KY No. 11	8.13	PDU Run 9, Period 23AB, syncrude mode, vacuum still overhead[‡,§]	156
		KY No. 11	8.06	PDU Run 9, Period 28AB, syncrude mode, vacuum still overhead[‡,§]	156
		IL No. 6	9.19	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, atmospheric still bottoms[*,†]	155
		IL No. 6	8.74	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, atmospheric still bottoms[*,†]	155
		IL No. 6	9.21	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, atmospheric still bottoms[*,†]	155
		KY No. 11	9.27	PDU Run 9, Period 6AB, syncrude mode, atmospheric still bottoms[‡,§]	156
		KY No. 11	8.99	PDU Run 9, Period 12AB, syncrude mode, atmospheric still bottoms[‡,§]	156

(Continued)

Table 211 (Continued)

Material	Process	Coal Type	Value (Wt %O)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	KY No. 11	9.02	PDU Run 9, Period 18AB, syncrude mode, atmospheric still bottoms‡,§	156
		KY No. 11	8.84	PDU Run 9, Period 23AB, syncrude mode, atmospheric still bottoms‡,§	156
		KY No. 11	9.21	PDU Run 9, Period 28AB, syncrude mode, atmospheric still bottoms‡,§	156
		IL No. 6	4.73	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, vacuum still bottoms*,†	155
		IL No. 6	4.57	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, vacuum still bottoms*,†	155
		IL No. 6	4.49	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, vacuum still bottoms*,†	155
		KY No. 11	4.32	PDU Run 9, Period 6AB, syncrude mode, vacuum still bottoms‡,§	156
		KY No. 11	4.35	PDU Run 9, Period 12AB, syncrude mode, vacuum still bottoms‡,§	156
		KY No. 11	4.58	PDU Run 9, Period 18AB, syncrude mode, vacuum still bottoms‡,§	156
		KY No. 11	4.78	PDU Run 9, Period 23AB, syncrude mode, vacuum still bottoms‡,§	156
		KY No. 11	4.48	PDU Run 9, Period 28AB, syncrude mode, vacuum still bottoms‡,§	156

(Continued)

Table 211 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	NA	12.02	PDU fuel oil mode, atmospheric still overhead	91
		NA	8.47	PDU, fuel oil mode, vacuum still overhead	91
		NA	9.01	PDU, fuel oil mode, atmospheric still bottoms	91
		NA	4.56	PDU, fuel oil mode, vacuum still bottoms	91
		NA	4.16	PDU, syncrude mode, vacuum still bottoms	91
		IL No. 6 (Burning Star Mine)	11.0	PDU, blend of atmospheric still overhead and bottoms	144
		NA	9.27	PDU, atmospheric still bottoms	84
		IL No. 6	11.8	PDU, syncrude mode, atmospheric still overhead, DOE Sample No. 1308	151
		IL No. 6	9.4	PDU, syncrude mode, atmospheric still bottoms, DOE Sample No. 1309	151
		IL No. 6	8.7	PDU, syncrude mode, vacuum still overhead, DOE Sample No. 1310	151
		IL No. 6	4.3	PDU, syncrude mode, vacuum still bottoms, DOE Sample No. 1311	151
		IL. No. 6	11.4	PDU, fuel oil mode, atmospheric still overhead, DOE Sample No. 1312	151
		IL. No 6	9.5	PDU, fuel oil mode, atmospheric still bottoms, DOE Sample No. 1313	151

(Continued)

Table 211 (Concluded)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	8.7	PDU, fuel oil mode, vacuum still overhead, DOE Sample No. 1314	151
		IL No. 6	4.7	PDU, fuel oil mode, vacuum still bottoms, DOE Sample No. 1315	151

Explanatory Notes:

*See General Comments section, Note 2, for summary of operating conditions used.

†Periods 3AB, 11B and 20AB are considered representative periods for the entire PDU Run 8, which consisted of over 32 individual periods.

‡See General Comments section, Note 3, for summary of operating conditions used.

§Periods 6AB, 12AB, 18AB, 23AB and 28AB are considered representative periods for the entire PDU Run 9, which consisted of over 30 individual periods.

Table 212. Trace Element Content (ppmw)

Material	Process	Coal Type	Ti	Na	K	Ca	V	Pb	Fe	P	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	NA	<1.0	0.64	0.07	0.38	0.1	0.06	2.3	<0.2	Wilsonville pilot plant, process solvent	84
		NA	<0.1	0.70	0.12	1.0	0.1	0.2	13.0	0.2	Wilsonville pilot plant, wash solvent	84
		NA	5.01	0.38	<0.1	<9	0.19	NA	107	NA	Ft. Lewis pilot plant, process solvent	106
		NA	<0.9	0.42	0.08	<6	<0.01	NA	7.59	NA	Ft. Lewis pilot plant, wash solvent	106
		NA	NA	1.7 ± 0.03	NA	NA	NA	NA	14 ± 1	NA	Ft. Lewis pilot plant, process solvent	146
	EDS	NA	0.07	12.0	1.2	2.6	0.02	0.3	3.1	1.8	One tpd pilot plant, hydrogenated recycle solvent	84
	H-Coal	NA	<0.1	1.90	1.5	0.36	0.12	0.42	58.0	<0.01	PDU, atmospheric still bottoms	84

(Continued)

Table 212 (Continued)

Material	Process	Coal Type	Al	Cl	Mn	As	Sb	Se	Hg	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	NA	NA	NA	NA	NA	NA	NA	NA	Wilsonville pilot plant, process solvent	84
		NA	NA	NA	NA	NA	NA	NA	NA	Wilsonville pilot plant, wash solvent	84
		NA	1.30	66.8	1.23	0.38	0.0068	0.019	<0.0001	Ft. Lewis pilot plant, process solvent	106
		NA	<0.2	89.3	0.11	0.015	<2.0	0.017	0.00566	Ft. Lewis pilot plant, wash solvent	106
		NA	NA	NA	NA	0.013± 0.001	<0.002	<0.008	0.07± 0.01*	Ft. Lewis pilot plant, process solvent	146
	EDS	NA	NA	NA	NA	NA	NA	NA	NA	One tpd pilot plant, hydrogenated recycle solvent	84
	H-Coal	NA	NA	NA	NA	NA	NA	NA	NA	PDU, atmospheric still bottoms	84

(Continued)

Table 212 (Continued)

Material	Process	Coal Type	Br	Ni	Co	Cr	Rb	Cs	Sample Description/Source	Reference
Coal liquid inter-mediates	SRC-I	NA	NA	NA	NA	NA	NA	NA	Wilsonville pilot plant, process solvent	84
		NA	NA	NA	NA	NA	NA	NA	Wilsonville pilot plant, wash solvent	84
		NA	0.52	<0.4	0.037	4.51	<0.07	0.00371	Ft. Lewis pilot plant, process solvent	106
		NA	0.011	<0.2	0.015	0.020	NA	0.00543	Ft. Lewis pilot plant, wash solvent	106
		NA	0.018 ± 0.002	NA	0.0026 ± 0.0005	0.044 ± 0.009	<0.05	<0.001	Ft. Lewis pilot plant, process solvent	146
	EDS	NA	NA	NA	NA	NA	NA	NA	One tpd pilot plant, hydrogenated recycle solvent	84
	H-Coal	NA	NA	NA	NA	NA	NA	NA	PDU, atmospheric still bottoms	84

(Continued)

Table 212 (Continued)

Material	Process	Coal Type	Tb	Eu	Sm	Ce	La	Sr	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	NA	NA	NA	NA	NA	NA	NA	Wilsonville pilot plant, process solvent	84
		NA	NA	NA	NA	NA	NA	NA	Wilsonville pilot plant, wash solvent	84
		NA	<0.002	0.00200	0.00259	<0.01	0.00287	<0.6	Ft. Lewis pilot plant, process solvent	106
		NA	<0.001	0.00231	<0.00005	<0.009	<0.0007	<0.5	Ft. Lewis pilot plant, wash solvent	106
		NA	<0.0002	<0.0001	0.0002	NA	<0.001	NA	Ft. Lewis pilot plant, process solvent	146
	EDS	NA	NA	NA	NA	NA	NA	NA	One tpd pilot plant, hydrogenated recycle solvent	84
	H-Coal	NA	NA	NA	NA	NA	NA	NA	PDU, atmospheric still bottoms	84

(Continued)

Table 212 (Continued)

Material	Process	Coal Type	Ba	Th	Hf	Ta	Sample Description/Source	Reference
Coal liquid inter-mediates	SRC-I	NA	NA	NA	NA	NA	Wilsonville pilot plant, process solvent	84
		NA	NA	NA	NA	NA	Wilsonville pilot plant, wash solvent	84
		NA	<0.7	0.00525	<0.002	0.00336	Ft. Lewis pilot plant, process solvent	106
		NA	<0.6	<0.001	<0.001	<0.002	Ft. Lewis pilot plant, wash solvent	106
		NA	<1	<0.0009	<0.003	NA	Ft. Lewis pilot plant, process solvent	146
	EDS	NA	NA	NA	NA	NA	One tpd pilot plant, hydrogenated recycle solvent	84
	H-Coal	NA	NA	NA	NA	NA	PDU, atmospheric still bottoms	84

(Continued)

Table 212 (Concluded)

Material	Process	Coal Type	Ga	Zr	Cu	Zn	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	NA	NA	NA	NA	NA	Wilsonville pilot plant, process solvent	84
		NA	NA	NA	NA	NA	Wilsonville pilot plant, wash solvent	84
		NA	0.017	NA	0.28	0.50	Ft. Lewis pilot plant, process solvent	106
		NA	<0.002	0.24	0.00961	0.054	Ft. Lewis pilot plant, wash solvent	146
		NA	NA	NA	NA	0.058± 0.04	Ft. Lewis pilot plant, process solvent	146
	EDS	NA	NA	NA	NA	NA	One tpd pilot plant, hydrogenated recycle solvent	84
	H-Coal	NA	NA	NA	NA	NA	PDU, atmospheric still bottoms	84

Explanatory Notes:

*Determined by Flameless Atomic Absorption Analysis

†Determined by Neutron Activation Analysis

Table 213. Ash Content (by Ultimate Analysis)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	NA	<0.01	Wilsonville pilot plant, process solvent	84
		NA	<0.01	Wilsonville pilot plant, wash solvent	84
	EDS	NA	0.0	One tpd pilot plant, hydrogenated recycle solvent	84
		NA	0.001	One tpd pilot plant, hydrogenated recycle solvent, reprocessed to remove 650°F+ fraction	84
	H-Coal	NA	0.01	PDU, atmospheric still bottoms	84
		IL No. 6 (Burning Star Mine)	0.0067	PDU, blend of atmospheric still overhead and bottoms	144

Table 214 Saturates, Olefins and Aromatics Contents

Material	Process	Coal Type	Compound Class	Value (wt %)	Sample Description/Source	Reference
Coal liquid inter-mediates	EDS	IL No. 6	Naphthenes	1.42	One tpd pilot plant, vacuum gas oil	99
			Aromatics			
			-Volatile	81.71		
			Polars	16.87		
			Total	100.00		
		Wyodak	Naphthenes	0.32	One tpd pilot plant, vacuum gas oil	99
			Aromatics			
			-Volatile	65.33		
			-Non-Volatile	12.20		
			Polars	22.15		
			Total	100.00		
		IL No. 6	Saturates	10.0	One tpd pilot plant, process solvent	99
			Aromatics	90.0		
	H-Coal	IL No. 6 (Burning Star Mine)	Saturates	12.08	PDU, fuel oil mode, blend of atmospheric still overhead and vacuum still overhead streams (analyzed by BETC)*	97
			Olefins	2.10		
			Aromatics	12.18		
		IL No. 6 (Monterey Mine)	Saturates	14.73	PDU, syncrude mode, blend of atmospheric still overhead and vacuum still overhead streams (analyzed by BETC)*	97
			Olefins	1.24		
			Aromatics	10.93		

Explanatory Notes

*See Part VIII, General Comments section, Note 3, for summary of operating conditions used.

Table 215. Detailed Hydrocarbon Class Compound Analysis

Material	Process	Coal Type	Compound	Value (wt %)	Sample Description/Source	Reference
Coal liquid inter-mediates	SRC-I	NA	Naphthalene	0.0100	Ft. Lewis pilot plant, process solvent	146
			2-Methylnaphthalene	0.3800		
			1-Methylnaphthalene	0.0930		
			Dimethylnaphthalene	1.1200		
			Dimethylnaphthalene	0.1700		
			Dimethylnaphthalene	0.4200		
			Dimethylnaphthalene	0.0650		
			2-Isopropylnaphthalene	0.0050		
			1-Isopropylnaphthalene	0.1400		
			C_4-Naphthalene	0.0050		
			Biphenyl	0.5900		
			Acenaphthylene	0.3400		
			Dimethylbiphenyl	0.2100		
			Dimethylbiphenyl	0.0560		
			Fluorene	0.6600		
			9-Methylfluorene	0.3100		
			1-Methylfluorene	0.3000		
			Anthracene/phenanthrene	2.3000		
			Methylphenanthrene	0.6200		
			1-Methylphenanthrene	0.3900		
			C_2-Anthracene	0.0500		
			Fluoranthene	1.0500		
			Dihydropyrene	0.1200		

(Continued)

Table 215 (Continued)

Material	Process	Coal Type	Compound	Value (wt %)	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	NA	Pyrene	1.1200	Ft. Lewis pilot plant, wash solvent	146
			-Undecane	0.0050		
			-Dodecane	0.0080		
			-Tridecane	0.0030		
			-Tetradecane	0.0340		
			-Pentadecane	0.1000		
			-Hexadecane	0.2000		
			-Heptadecane	0.3100		
			-Octadecane	0.0920		
			-Nonadecane	0.0800		
			-Eicosane	0.0930		
			-Heneicosane	0.0600		
			-Docosane	0.0670		
			-Tricosane	0.0980		
			-Tetracosane	0.0900		
			-Pentacosane	0.0740		
			-Hexacosane	0.0450		
			-Heptacosane	0.0300		
			-Octacosane	0.0150		
			-Nonacosane	0.0090		
			-Triacontane	0.0060		
			-Hentriacontane	0.0040		
			-Dotriacontane	0.0010		
			-Tritriacontane	0.0005		

(Continued)

Table 215 (Continued)

Material	Process	Coal Type	Compound	Value (wt %)	Sample Description/Source	Reference
Coal liquid inter-mediates	SRC-I	NA	Xylene	0.1300	Ft. Lewis pilot plant, wash solvent	146
			-Ethylbenzene	0.1700		
			-Ethylbenzene	0.0700		
			C_3-Benzene	0.1500		
			C_4-Benzene	0.0500		
			Indan	1.3000		
			Methylindan	0.2500		
			Methylindan	0.1400		
			Methylindan	0.2300		
			Dimethylindan	0.0040		
			Tetralin	0.4100		
			Dimethyltetralin	0.1500		
			6-Methyltetralin	0.3200		
			Naphthalene	3.2000		
			2-Methylnaphthalene	3.2000		
			1-Methylnaphthalene	1.2000		
			Dimethylnaphthalene	1.3000		
			Dimethylnaphthalene	0.0700		
			Dimethylnaphthalene	0.4000		
			Dimethylnaphthalene	0.0160		
			2-Isopropylnaphthalene	0.0040		
			1-Isopropylnaphthalene	0.0210		
			C_4-Naphthalene	0.0005		

(Continued)

Table 215 (Continued)

Material	Process	Coal Type	Compound	Value (wt %)	Sample Description/Source	Reference
Coal liquid intermediates	SRC-I	NA	Cyclohexylbenzene	0.0410	Ft. Lewis pilot plant, wash solvent	146
			Biphenyl	1.0000		
			Acenaphthylene	0.0500		
			Dimethylbiphenyl	0.0035		
			Dimethylbiphenyl	0.0030		
			Fluorene	0.0250		
			9-Methylfluorene	0.0110		
			1-Methylfluorene	0.0010		
			Anthracene/phenanthrene	0.0130		
			Methylphenanthrene	0.0015		
			C_2-Anthracene	0.0025		
			Fluoranthene	0.0035		
			Dihydropyrene	0.0025		
			Pyrene	0.0040		
			-Octane	0.0900		
			-Nonane	0.2700		
			-Decane	0.5000		
			-Undecane	0.8300		
			-Dodecane	2.1000		
			-Tridecane	1.4000		
			-Tetradecane	1.1000		
			-Pentadecane	0.4000		
			-Hexadecane	0.0400		
			-Heptadecane	0.0120		
			-Octadecane	0.0040		
			-Nonadecane	0.0500		

(Continued)

Table 215 (Concluded)

Material	Process	Coal Type	Compound	Value (wt %)	Sample Description/Source	Reference
Coal liquid intermediates	EDS	IL No. 6	Volatile Aromatics		One tpd pilot plant, vacuum gas oil	99
			1-Ring	6.51		
			2-Ring	23.17		
			3-Ring	19.88		
			4+-Ring	18.77		
			Total	68.33		
		Wyodak	Volatile Aromatics		One tpd pilot plant, vacuum gas oil	99
			1-Ring	1.18		
			2-Ring	5.72		
			3-Ring	9.95		
			4+-Ring	26.01		
			Total	42.86		
	H-Coal	IL No. 6 (Burning Star Mine)	Paraffins	3.38	PDU, fuel oil mode, blend of atmospheric still overhead and vacuum still overhead streams, (analyzed by BETC)*	97
			Monocycloparaffins	5.56		
			Dicycloparaffins	4.92		
			Alkylbenzenes	5.13		
			Monocyclic benzenes (including indans and tetralins)	4.20		
			Naphthalenes	1.07		
			Total	24.26		
		IL No. 6 (Monterey Mine)	Paraffins	3.70	PDU, syncrude mode, blend of atmospheric still overhead and vacuum still overhead streams, (analyzed by BETC)*	97
			Monocycloparaffins	7.51		
			Dicycloparaffins	4.57		
			Alkylbenzenes	4.94		
			Monocyclic benzenes (including indans and tetralins)	3.80		
			Naphthalenes	1.14		
			Total	25.66		

Explanatory Notes

*See Part VIII, General Comments section, Note 3, for summary of operating conditions used.

Table 216. Compound Class Analysis Obtained by Solvent Fractionation

Material	Process	Coal Type	Compound Type	Value (wt %)	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6 (Burning Star Mine)	C_7 Insolubles	0.10	PDU, blend of atmospheric still overhead and bottoms	144
		IL No. 6	Toluene soluble Non-Ash Toluene insoluble	55.27 24.92	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, vacuum still bottoms*,†	155
		IL No. 6	Toluene soluble Non-Ash Toluene insoluble	48.40 33.14	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, vacuum still bottoms*,†	155
		IL No. 6	Toluene soluble Non-Ash Toluene insoluble	50.71 29.20	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, vacuum still bottoms*,†	155
		KY No. 11	Toluene soluble Non-Ash Toluene insoluble	51.19 23.10	PDU Run 9, Period 6AB, syncrude mode,‡ vacuum still bottoms†,§	156
		KY No. 11	Toluene soluble Non-Ash Toluene insoluble	55.83 23.53	PDU Run 9, Period 12AB, syncrude mode,‡ vacuum still bottoms†,§	156
		KY No. 11	Toluene soluble Non-Ash Toluene insoluble	52.86 28.54	PDU Run 9, Period 18AB, syncrude mode,‡ vacuum still bottoms†,§	156

(Continued)

Table 216 (Concluded)

Material	Process	Coal Type	Compound Type	Value (wt %)	Sample Description/Source	Reference
		KY No. 11	Toluene soluble	57.60	PDU Run 9, Period 23AB, syncrude mode,[‡] vacuum still bottoms[†],[§]	156
			Non-Ash Toluene insoluble	26.33		
		KY No. 11	Toluene soluble	54.66	PDU Run 9, Period 28AB, syncrude mode,[‡] vacuum still bottoms[†],[§]	156
			Non-Ash Toluene insoluble	25.24		

Explanatory Notes

*See General Comments section, Note 2, for summary of operating conditions used.

[†] Periods 3AB, 11B and 20AB are considered representative periods for the entire PDU Run 8, which consisted of over 32 individual periods.

[‡] See General Comments section, Note 3, for summary of operating conditions used.

[§] Periods 6AB, 12AB, 18AB, 23AB and 28AB are considered representative periods for the entire PDU Run 9, which consisted of over 30 individual periods.

Table 217. Nitrogen-, Oxygen- and Sulfur-Containing Compounds

Material	Process	Coal Type	Compound	Value (wt %)	Sample Description/Source	Reference
Coal liquid inter-mediates	SRC-I	NA	Dibenzofuran	0.5800	Ft. Lewis pilot plant, process solvent	146
			Xanthene	0.0840		
			Dibenzothiophene	0.4200		
			Methyldibenzothiophene	0.0320		
			Dimethyldibenzothiophene	0.1200		
			Thioxanthene	0.3300		
		NA	Dibenzofuran	0.0400	Ft. Lewis pilot plant, wash solvent	146
			Xanthene	0.0030		
			Dibenzothiophene	0.0050		
			Methyldibenzothiophene	0.0015		
			Dimethyldibenzothiophene	0.0015		
			Thioxanthene	0.0002		
	EDS	IL No. 6	Volatile Aromatics		One tpd pilot plant, vacuum gas oil	99
			Thiophenes			
			1-Ring	0.36		
			2-Ring	0.65		
			3-Ring	0.14		
			4+-Ring	0.06		
			Total	1.21		
			Furans			
			1-Ring	1.78		
			2-Ring	5.20		
			3-Ring	3.00		
			4+-Ring	2.14		
			Total	12.17		

(Continued)

Table 217 (Concluded)

Material	Process	Coal Type	Compound	Value (wt %)	Sample Description/Source	Reference
Coal liquid inter-mediates		Wyodak	Volatile Aromatics		One tpd pilot plant, vacuum gas oil	99
			Thiophenes			
			1-Ring	0.05		
			2-Ring	0.26		
			3-Ring	0.30		
			4^+-Ring	0.46		
			Total	1.07		
			Furans			
			1-Ring	0.93		
			2-Ring	5.96		
			3-Ring	6.84		
			4^+-Ring	7.67		
			Total	21.40		
	H-Coal	IL No. 6 (Burning Star Mine)	Pyridines	0.07	PDU, fuel oil mode, blend of atmospheric still overhead and vacuum still overhead streams (analyzed by BETC)*	97
			Anilines	0.31		
			Acids	7.94		
		IL No. 6 (Monterey Mine)	Pyridines	0.04	PDU, syncrude mode, blend of atmospheric still overhead and vacuum still overhead streams (analyzed by BETC)*	97
			Anilines	0.25		
			Acids	5.01		

Explanatory Notes

*See Part VIII, General Comments section, Note 3, for summary of operating conditions used.

Table 218. Compound Class Analysis Obtained by Solvent Fractionation (wt %)

Material	Process	Coal Type	Volatiles	Ether Insolubles	Ether Soluble Acids	Insoluble Acids	Ether Soluble Bases	Insoluble Bases	Neutral Saturates	Neutral Aromatics
Coal liquid inter-mediates	H-Coal	NA	0.6	NA	0.4	NA	2.0	0.8	20.2	62.6
		NA	0.2	NA	0.6	NA	2.5	0.4	10.2	63.7
		NA	NA	65.1	2.0	0.6	2.1	3.6	0.8	5.8
		NA	34.7	NA	0.9	NA	1.1	0.5	11.9	24.6
		NA	0.8	NA	0.6	0.1	2.1	NA	22.9	55.8
		NA	0.3	NA	1.2	0.3	2.6	NA	13.9	58.5
		NA	NA	59.5	0.2	0.8	1.8	9.6	1.3	8.0

(Continued)

Table 218 (Concluded)

Neutral Poly-Aromatics	Neutral Polar	Total	Neutral Fraction		Recovery	Sample Description/Source	Reference
			Experimental	Summation			
10.3	<0.1	96.9	97.1	93.1	95.9	PDU, syncrude mode, atmospheric still bottoms, DOE Sample No. 1309	136
22.8	<0.1	100.4	97.6	96.7	99.1	PDU, syncrude mode, vacuum still overhead, DOE Sample No. 1310	136
20.0	0.5	98.4	28.9	27.1	94.0	PDU, syncrude mode, vacuum still bottoms, DOE Sample No. 1311	136
0.5	<0.1	74.2	54.9	37.0	67.4	PDU, fuel oil mode, atmospheric still overhead, DOE Sample No. 1312	136
6.9	<0.1	89.2	94.1	85.6	91.0	PDU, fuel oil mode, atmospheric still bottoms, DOE Sample No. 1313	136
19.7	<0.1	96.5	95.1	92.1	96.8	PDU, fuel oil mode, vacuum still overhead, DOE Sample No. 1314	136
18.4	0.3	99.9	27.7	28.0	101.1	PDU, fuel oil mode, vacuum still bottoms, DOE Sample No. 1315	136

Table 219. Asphaltene Composition*

Material	Process	Coal Type		Starting Asphaltene	Benzene-Eluted	Et$_2$O-Eluted	THF-Eluted	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	NA	Molecular formula	$C_{35.59}H_{28.86}N_{0.56}O_{1.52}S_{0.10}$	$C_{40.62}H_{31.76}N_{0.42}O_{1.30}S_{0.11}$	$C_{36.21}H_{32.03}N_{0.64}O_{2.19}S_{0.09}$	$C_{49.40}H_{48.05}N_{0.80}O_{3.34}S_{0.16}$	PDU, heavy SRC, vacuum flash tower bottoms	157
			Molecular weight	492†	549‡	614‡	698‡		
			H^*_{ar}§	44	48	42	30		
			H^*	36	37	39	40		
			H^*_α	18	15	19	30		
			f_a(carbon aromaticity, fraction)	0.78	0.80	0.74	0.66		
			H'_{aru}/C'_{ar}	0.72	0.69	0.81	0.84		
			σ	0.34	0.32	0.39	0.47		
			$R_s = \sigma H'_{aru}$	6.7	7.2	8.4	13.0		
			$n = H^*_\alpha/H^*+1$	1.5	1.4	1.5	1.8		
			C'_{ar}	27.8	32.4	26.9	32.6		
			R_a = no. of aromatic rings	4.9	6.0	3.5	3.6		
			Atomic C/H	1.22	1.27	1.12	1.02		
			f	29.4	30.2	14.7	30.3		

Explanatory Notes

*Including silica-gel chromatography fractions.

†Average extrapolated infinite dilution values measured in benzene and in THF.

‡Extrapolated infinite dilution value measured in THF.

§Uncorrected for phenolic OH absorption.

Table 220. General Physical and Chemical Properties of Various Distillation Fractions of Coal Liquid Intermediates

Material	Process	Coal Type	Distillation Fraction	Value		Sample Descripion/Source	Reference
				210-480°F	300-500°F		
Coal liquid intermediates	H-Coal	NA	API Gravity (degrees)	30.0	30.4	PDU, from atmospheric still overhead	84
			Pour point, °F	<-65.0	<-65.0		
			Flash point, °F	<75.0	12.0		
			Gross heat of combustion, Btu/lb	18,723	18,810		
			Viscosity, (Centistokes)				
			104°F	1.12	1.17		
			212°F	0.62	0.60		
			Conradson Carbon residue, wt %	0.05	0.01		

(Continued)

Table 220 (Continued)

Material	Process	Coal Type	Distillation Fraction	Value		Sample Descripion/Source	Reference
				210-480°F	300-500°F		
Coal liquid intermediates	H-Coal	NA	Distillation Data*			PDU, from atmospheric still overhead	84
			IBP	236°F	220°F		
			5	278°F	262°F		
			10	304°F	280°F		
			30	338°F	333°F		
			50	374°F	368°F		
			70	401°F	398°F		
			90	442°F	440°F		
			95	470°F	462°F		
			EP	505°F	485°F		
			Distillation Simulated by Chromatography†				
			IBP	171	179		
			5	208	214		
			10	257	247		
			30	328	332		
			50	369	376		
			70	402	411		
			90	447	457		
			95	467	479		
			EP	550	537		

(Continued)

Table 220 (Continued)

Material	Process	Coal Type	Distillation Fraction	Value		Sample Descripion/Source	Reference
				210-480°F	300-500°F		
Coal liquid intermediates	H-Coal	NA	Ash Content, (by ultimate analysis) wt %	<0.01	<0.01	PDU, from atmospheric still overhead	84
			Distillation Fraction	IBP-400°F	400°F		
		IL No. 6	API Gravity (degrees)	38.2	19.4	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, atmospheric still overhead[‡,§]	155
			Distillation Fraction	IBP-400°F	400°F		
		IL No. 6	API Gravity (degrees)	39.8	18.2	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, atmospheric still overhead[‡,§]	155

(Continued)

Table 220 (Continued)

Material	Process	Coal Type	Distillation Fraction	Value IBP-650°F	 650°F+	Sample Descripion/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	API Gravity (degrees)	35.6	19.0	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, atmospheric still overhead‡,§	155
			Distillation Fraction	IBP-650°F	650°F+		
		IL No. 6	API Gravity (degrees)	11.2	1.6	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, atmospheric still bottoms‡,§	155
			Distillation Fraction	IBP-650°F	650°F+		
		IL No. 6	API Gravity (degrees)	11.3	2.3	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, atmospheric still bottoms‡,§	155

(Continued)

Table 220 (Continued)

Material	Process	Coal Type	Distillation Fraction	Value		Sample Descripion/Source	Reference
				IBP-650°F	650°F+		
Coal liquid intermediates	H-Coal	IL No. 6	API Gravity (degrees)	13.5	4.7	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, atmospheric still bottoms[‡,§]	155
		IL No. 6	API Gravity (degrees)	8.7	0.1	PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, vacuum still overhead[‡,§]	155
			Distillation Fraction	IBP-650°F	650°F+		
		IL No. 6	API Gravity (degees)	8.4	0.5	PDU Run 8, Period 11B, fuel oil mode with high catalyst age, vacuum still overhead[‡,§]	155

(Continued)

Table 220 (Continued)

Material	Process	Coal Type	Distillation Fraction	Value IBP-650°F	 650°F$^+$	Sample Descripion/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	API Gravity (degrees)	11.1	4.7	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, vacuum still overhead[‡,§]	155
			Distillation Fraction	IBP-975°F$^+$			
		IL No. 6	API Gravity (degrees)	-5.7		PDU Run 8, Period 3AB, fuel oil mode with low catalyst age, vacuum still bottoms[‡,§]	155
		IL No. 6	API Gravity (degrees)	-8.5		PDU Run 8, Period 11B, fuel oil mode with high catalyst age, vacuum still bottoms[‡,§]	155

(Continued)

Table 220 (Continued)

Material	Process	Coal Type	Distillation Fraction	Value IBP-650°F	 650°F+	Sample Descripion/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	API Gravity (degrees)	-3.7	NA	PDU Run 8, Period 20AB, intermediate mode with high catalyst age, vacuum still bottoms[‡],[§]	155
			Distillation Fraction	IBP-400°F	400°F+		
		KY No. 11	API Gravity (degrees)	40.8	22.8	PDU Run 9, Period 6AB, syncrude mode, atmospheric still overhead[#],[**]	156
			Distillation Fraction	IBP-400°F	400°F+		
		KY No. 11	API Gravity (degrees)	40.5	22.0	PDU Run 9, Period 12AB, syncrude mode, atmospheric still overhead[#],[**]	156

(Continued)

Table 220 (Continued)

Material	Process	Coal Type	Distillation Fraction	Value IBP-650°F	Value 650°F$^+$	Sample Descripion/Source	Reference
Coal liquid intermediates	H-Coal	KY No. 11	API Gravity (degrees)	39.5	21.6	PDU Run 9, Period 18AB, syncrude mode, atmospheric still overhead$^\#$,**	156
			Distillation Fraction	IBP-400°F	400°F$^+$		
		KY No. 11	API Gravity (degrees)	38.2	20.1	PDU Run 9, Period 23AB, syncrude mode, atmospheric still overhead$^\#$,**	156
			Distillation Fraction	IBP-400°F	400°F$^+$		
		KY No. 11	API Gravity (degrees)	42.1	20.3	PDU Run 9, Period 28AB, syncrude mode, atmospheric still overhead$^\#$,**	156

(Continued)

Table 220 (Continued)

Material	Process	Coal Type	Distillation Fraction	Value IBP-650°F	 650°F$^+$	Sample Descripion/Source	Reference
Coal liquid intermediates	H-Coal	KY No. 11	API Gravity (degrees)	13.9	3.6	PDU Run 9, Period 6AB, syncrude mode, atmospheric still bottoms#,**	156
			Distillation Fraction	IBP-650°F	650°F$^+$		
		KY No. 11	API Gravity (degrees)	13.4	1.8	PDU Run 9, Period 12AB, syncrude mode, atmospheric still bottoms#,**	156
			Distillation Fraction	IBP-650°F	650°F$^+$		
		KY No. 11	API Gravity (degrees)	13.5	3.1	PDU Run 9, Period 18AB, syncrude mode, atmospheric still bottoms#,**	156

(Continued)

Table 220 (Continued)

Material	Process	Coal Type	Distillation Fraction	Value IBP-650°F	 650°F$^+$	Sample Descripion/Source	Reference
Coal liquid intermediates	H-Coal	KY No. 11	API Gravity (degrees)	12.6	2.3	PDU Run 9, Period 23AB, syncrude mode, atmospheric still bottoms$^\#$,**	156
			Distillation Fraction	IBP-650°F	650°F$^+$		
		KY No. 11	API Gravity (degrees)	14.4	1.8	PDU Run 9, Period 28AB, syncrude mode, atmospheric still bottoms$^\#$,**	156
			Distillation Fraction	IBP-650°F	650°F$^+$		
		KY No. 11	API Gravity (degrees)	12.3	0.1	PDU Run 9, Period 6AB, syncrude mode,vacuum still overhead$^\#$,**	156

(Continued)

Table 220 (Continued)

Material	Process	Coal Type	Distillation Fraction	Value		Sample Descripion/Source	Reference
				IBP-650°F	650°F$^+$		
Coal liquid intermediates	H-Coal	KY No. 11	API Gravity (degrees)	11.0	-0.8	PDU Run 9, Period 12AB, syncrude mode, vacuum still overhead$^{\#}$,**	156
			Distillation Fraction	IBP-650°F	650°F$^+$		
		KY No. 11	API Gravity (degrees)	10.6	-1.2	PDU Run 9, Period 18AB, syncrude mode, vacuum still overhead$^{\#}$,**	156
			Distillation Fraction	IBP-650°F	650°F$^+$		
		KY No. 11	API Gravity (degrees)	7.9	-0.9	PDU Run 9, Period 23AB, syncrude mode, vacuum still overhead$^{\#}$,**	156
			Distillation Fraction	IBP-650°F	650°F$^+$		
		KY No. 11	API Gravity (degrees)	11.0	-0.8	PDU Run 9, Period 12AB, syncrude mode, vacuum still overhead$^{\#}$,**	156

(Continued)

Table 220 (Continued)

				Value			
Material	Process	Coal Type	Distillation Fraction	IBP-650°F	650°F+	Sample Descripion/Source	Reference
Coal liquid intermediates	H-Coal	KY No. 11	API Gravity (degrees)	-6.5	NA	PDU Run 9, Period 6AB, syncrude mode, vacuum still bottoms[‡],[**]	156
			Distillation Fraction	IBP-975°F			
		KY No. 11	API Gravity (degrees)	-9.6	NA	PDU Run 9, Period 12AB, syncrude mode, vacuum still bottoms	156
			Distillation Fraction	IBP-975°F			
		KY No. 11	API Gravity (degrees)	-9.8	NA	PDU Run 9, Period 23AB, syncrude mode, vacuum still bottoms	156
			Distillation Fraction	IBP-975°F			
		KY No. 11	API Gravity (degrees)	-10.2	NA	PDU Run 9, Period 28AB, syncrude mode, vacuum still bottoms	156

(Continued)

Table 220 (Continued)

Material	Process	Coal Type	Distillation Fraction No.	Cut Temp °F	Specific Gravity 60/60°F	°API 60°F	Refractive Index n_0 at 20°C	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	IL No. 6	1 (Stage 1, 760 mm Hg)	122	NA	NA	NA	PDU, fuel oil mode, blend of atmospheric still overhead and vacuum still overhead	97
			2	167	NA	NA	NA		
			3	212	0.760	54.7	1.41756		
			4	257	.783	49.2	1.43517		
			5	302	.818	41.5	1.45236		
			6	347	.874	30.4	1.47633		
			7	392	.919	22.5	1.47155		
			8	437	.939	19.2	NA		
			9	482	.947	17.9	NA		
			10	527	.964	15.3	NA		
			11 (Stage 2, 40 mm Hg)	392	1.001	9.9	NA		
			12	437	1.030	5.9	NA		
			13	482	1.071	.6	NA		
			14	527	NA	NA	NA		
			15	572	NA	NA	NA		
			Residuum		1.140	NA	NA		

(Continued)

Table 220 (Concluded)

Material	Process	Coal Type	Distillation Fraction No.	Cut Temp °F	Specific Gravity 60/60°F	°API 60°F	Refractive Index n_o at 20°C	Sample Description/Source	Reference
Coal liquid inter-mediates	H-Coal	IL No. 6	1 (Stage 1, 760 mm Hg)	122	NA	NA	NA	PDU, syncrude mode, blend of atmospheric still overhead and vacuum still overhead	97
			2	167	NA	NA	NA		
			3	212	0.744	58.7	1.41259		
			4	257	.775	51.1	1.42667		
			5	302	.811	43.0	1.44643		
			6	347	.865	32.1	1.47238		
			7	392	.911	23.8	1.49868		
			8	437	.936	19.7	1.51897		
			9	482	.955	16.7	NA		
			10	527	.973	13.9	NA		
			11 (Stage 2, 40 mm Hg)	392	1.001	9.9	NA		
			12	437	1.045	3.9	NA		
			13	482	1.063	1.6	NA		
			14	527	1.087	NA	NA		
			15	572	1.112	NA	NA		
			Residuum		1.158	NA	NA		

Explanatory Notes

*Determined via ASTM D-86.

†Determined via ASTM D-2887.

‡See General Comments section, Note 2, for summary of operating conditions used.

§Periods 3AB, 11B and 20AB are considered representative periods for the entire PDU Run 8, which consisted of over 32 individual periods.

#See General Comments section, Note 3, for summary of operating conditions used.

**Periods 6AB, 12AB, 18AB, 23AB and 28AB are considered representative periods for the entire PDU Run 9, which consisted of over 30 individual periods.

Table 221. Elemental Composition of Various Distillation Fractions of Coal Liquid Intermediates

Material	Process	Coal Type	Distillation Fraction	Value		Sample Description/Source	Reference
				210-480°F	300-500°F		
Coal liquid inter-mediates	H-Coal	NA	H, wt%	11.38	11.19	PDU, from atmospheric still overhead	84
			S, wt %	0.13	0.16		
			N, wt %	0.16	0.16		
			O, wt %	1.4	1.1		
			Trace Metals (ppm)				
			Ti	<1.0	<2.0		
			Na	0.43	1.1		
			K	0.06	0.15		
			Ca	0.15	0.16		
			V	0.9	<0.1		
			Pb	0.02	0.04		
			Fe	0.7	1.0		
			P	<0.2	<0.1		
			Distillation Fraction	IBP-400°F	400°F$^+$		
		IL No. 6	S, wt %	0.09	0.27	PDU, Run 8, Period 3AB, fuel oil mode with low catalyst age, atmospheric still overhead*,†	155
			Distillation Fraction	IBP-400°F	400°F$^+$		
		IL No. 6	S, wt %	0.24	0.32	PDU, Run 8, Period 11B, fuel oil mode with high catalyst age, atmospheric still overhead*,†	155

(Continued)

Table 221 (Continued)

Material	Process	Coal Type	Distillation Fraction	Value		Sample Description/Source	Reference
				IBP-400°F	400°F$^+$		
Coal liquid inter-mediates	H-Coal	IL No. 6	S, wt %	0.24	0.13	PDU, Run 8, Period 20AB, intermediate mode with high catalyst age, atmospheric still overhead*,†	155
			Distillation Fraction	IBP-400°F	400°F$^+$		
		KY No. 11	S, wt %	<0.03	<0.03	PDU, Run 9, Period 6AB, syncrude mode, atmos-pheric still overhead‡,§	156
			Distillation Fraction	IBP-400°F	400°F$^+$		
		KY No. 11	S, wt %	0.13	<0.03	PDU, Run 9, Period 12AB, syncrude mode, atmos-pheric still overhead‡,§	156
			Distillation Fraction	IBP-400°F	400°F$^+$		
		KY No. 11	S, wt %	0.07	0.08	PDU, Run 9, Period 18AB, syncrude mode, atmos-pheric still overhead‡,§	156

(Continued)

Table 221 (Concluded)

Material	Process	Coal Type	Distillation Fraction	Value IBP-400°F	 400°F$^+$	Sample Description/Source	Reference
Coal liquid intermediates	H-Coal	KY No. 11	S, wt %	0.20	0.11	PDU, Run 9, Period 23AB, syncrude mode, atmospheric still overhead‡,§	156
			Distillation Fraction	IBP-400°F	400°F$^+$		
		KY No. 11	S, wt %	0.13	0.11	PDU, Run 9, Period 28AB, syncrude mode, atmospheric still overhead‡,§	156

Explanatory Notes

*See General Comments section, Note 2, for summary of operating conditions used.

†Periods 3AB, 11B and 20AB are considered representative periods for the entire PDU Run 8, which consisted of over 32 individual periods.

‡See General Comments section, Note 3, for summary of operating conditions used.

§Periods 6AB, 12AB, 18AB, 23AB and 28AB are considered representative periods for the entire PDU Run 9, which consisted of over 30 individual periods.

Table 222. Detailed Hydrocarbon and Heterocyclic-Compound Analysis for Various Distillation Fractions of Coal Liquid Intermediates

Material	Process	Coal Type	CCGC-MS Scan No.*	Value		Sample Description/Source	Reference
				Compound	Comments		
Coal liquid inter-mediates	SRC-I	NA	171	A methylphenol	Plus 2,5-dimethylphenol (or possibly another isomer)	Wilsonville pilot plant, Run 220, heavy distil-late cut (400-650°F) from process solvent	149
			245	1,2,3,4-Tetrahydronaphthalene	Plus an ethylphenol		
			268	Naphthalene			
			306	2-Methyl-1,2,3,4-tetrahydronaphthalene			
			364	1,2,3,4-Tetrahydro-5-methylnaphthalene	Or 6-methyl isomer		
			379	Possibly a 2-ethylmethylphenol	Major ions at 1/z = 136, 121 (100%), 108, and 107		
			399	2-Methylnaphthalene			
			415	1-Methylnaphthalene			
			503	1,1'-Biphenyl			
			518	2-Ethylnaphthalene			
			532	A dimethylnaphthalene			
			549	Tetradecane			
			570	See scan 532			
			594	2-Isopropylnaphthalene	Possibly an ethylmethylnaphthalene		
			620	1,2-Dihydroacenaphthylene			
			634	An n-propylnaphthalene	Plus M.Wt. 168		
			653	2-Isopropylnaphthalene	See scan 594		
			660	Dibenzofuran			
			672	Pentadecane			
			736	9H-Fluorene			
			750	4-Methyl-1,1'-biphenyl	Or perinaphthalene (mol wt 168)		
			758	See scan 750			
			766	2-Methyl-1-propylnaphthalene	Plus a methylbiphenyl (see scan 750) and a methyl-9H-fluorene (M.Wt. 180)		
			784	A dimethylbiphenyl	Possibly a methylperinaphthalene		
			791	Hexadecane			
			798	4-Methyldibenzofuran	Possibly Biphenyl-4-carboxaldehyde		
			824	C_2-Alkylbiphenyl			
			846	9,10-Dihydroanthracene			
			859	9,10-Dihydrophenanthrene			
			867	A methyl-9H-fluorene			
			877	See scan 867	Plus a C_2-alkylbiphenyl (see note at scan 784)		
			888	A butylmethylnaphthalene	Plus a C_2-alkylbiphenyl		
			905	Heptadecane	Plus a C_2-alkylbiphenyl		

(Continued)

Table 222 (Concluded)

Material	Process	Coal Type	CCGC-MS Scan No.*	Value: Compound	Value: Comments	Sample Description/Source	Reference
Coal liquid inter-mediates	SRC-I	NA	922	Possibly a C_2-alkylbiphenyl	See note at scan 784.	Wilsonville pilot plant, Run 220, heavy distil-late cut (650-850°F) from process solvent	149
			928	Mixture	Includes M.Wt. 196		
			956	Phenanthrene			
			1014	Octadecane			
			1022	9H-Carbazole			
			1045	Mixture	Includes M.Wt. 196 and 210		
			1071	A methylphenanthrene			
			1077	See scan 1071			
			1116	Nonadecane			
			1214	Eicosane			
			1300	Heneicosane			
			1399	Docosane			
			1014	9H-Carbazole			
			1071	A methylphenanthrene			
			1087	See scan 1071			
			1148	2-Phenylnaphthalene			
			1161	An ethylphenanthrene			
			1177	See scan 1161			
			1224	Fluoranthene			
			1270	Pyrene			
			1281	1-Phenylnaphthalene			
			1365	A methylpyrene	Possibly a methylfluoranthene or a benzofluorene		
			1383	See scan 1365			
			1394	See comment	M.Wt. 218. Possibly a methylphenylnaphthalene		
			1400	Docosane			
			1488	Tricosane	Plus M.Wt. 230. Possibly a dimethylpyrene		
			1562	Chrysene			
			1572	Tetracosane	Possibly another M.Wt. 228 polynuclear aromatic hydrocarbon		
			1653	Pentacosane			
			1666	A methylbenz[a]anthracene	Possibly another M.WT. 242 isomer		
			1731	Hexacosane			
			1807	Heptacosane			
			1880	Nonacosane			
			1950	Triacontane			
			2019	Hentriacontane			
			2085	Dotriacontane			
			2150	Tritriacontane			

Explanatory Notes

*Determined via capillary column gas chromatography and mass spectrometry (CCGC-MS).

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Table 223. Nitrogen-Containing Compounds in Various Distillation Fractions of Coal Liquid Intermediates*

Material	Process	Coal Type	Carbon No	Compound	Molecular Weight Underivatized	Fluoramide Derivative	600-650	650-700	700-750	750-800	800-850†	Sample Description/Source	Reference
Coal raw heavy distillates and residue	SRC-I	NA	C_3	Aniline	135	281	X†					Wilsonville pilot plant, process solvent	127
			C_4	Aniline	149	295	X						
			C_1	Aminoindan	145	291	X						
			C_2	Aminoindan	159	305	X						
				Aminonaphthalene	143	289	X						
			C_1	Aminonaphthalene	157	303	X	X					
			C_2	Aminonaphthalene	171	317	X	X					
			C_3	Aminonaphthalene	185	331	X	X					
			C_4	Aminonaphthalene	199	345		X					
				Aminobiphenyl	169	315		X					
			C_1	Aminobiphenyl	183	329		X					
			C_2	Aminobiphenyl	197	343		X					
			C_3	Aminobiphenyl	211	357		X	X				
			C_4	Aminobiphenyl	225	371		X	X				
				Aminofluorene	181	327		X					
			C_1	Aminofluorene	195	341			X				
			C_2	Aminofluorene	209	355			X	X			
			C_3	Aminofluorene	223	369			X	X			
			C_4	Aminofluorene	237	383				X			
				Aminophenanthrene	193	339			X	X			
			C_1	Aminophenanthrene	207	353			X	X			
			C_2	Aminophenanthrene	221	367			X	X			
			C_3	Aminophenanthrene	235	381			X	X			
			C_4	Aminophenanthrene	249	395				X	X		
				Aminophenylnaphthalene	219	365			X	X			
			C_1	Aminophenylnaphthalene	233	379				X			
			C_2	Aminophenylnaphthalene	247	393				X			
			C_3	Aminophenylnaphthalene	261	407							
			C_4	Aminophenylnaphthalene	275	421					X		
				Aminopyrene	217	363				X			
			C_1	Aminopyrene	231	377				X			
			C_2	Aminopyrene	245	391				X			
			C_3	Aminopyrene	259	405				X	X		
			C_4	Aminopyrene	273	419					X		
				Aminocyclopentapyrene	241	387				X	X		
			C_1	Aminocyclopentapyrene	255	401				X	X		
			C_2	Aminocyclopentapyrene	269	415					X		
				Aminobenzanthracene	243	389				X	X		
			C_1	Aminobenzanthracene	257	403				X	X		
			C_2	Aminobenzanthracene	271	417				X	X		
			C_3	Aminobenzanthracene	285	431					X		
			C_4	Aminobenzanthracene	299	445					X		
			C_5	Aminobenzanthracene	313	459					X		
			C_6	Aminobenzanthracene	327	473					X		
				Aminobinaphthyl	269	415					X		
			C_1	Aminobinaphthyl	283	429					X		
			C_2	Aminobinaphthyl	297	443					X		
			C_3	Aminobinaphthyl	311	457					X		
			C_4	Aminobinaphthyl	325	471					X		
				Aminobenzopyrene	267	413					X		
			C_1	Aminobenzopyrene	281	427					X		

Explanatory Notes

*Determined by electRon capture detection, gas chromatography, direct probe mass spectrometry and gas chromatography/mass spectrometry.

GENERAL COMMENTS

1. Naphthalene, fluoranthene and pyrene have been identified via mass spectrometry in raw SRC-I and SRC-II whole process liquids. The SRC-I liquid was derived from a 50 lb/day PDU and KY No. 9 coal. The SRC-II liquid was derived from the Ft. Lewis pilot plant (ORNL Sample No. RCS-UFO-13) and Pittsburgh No. 8 coal (Reference 139).

2. Data cited for Reference 155 for H-Coal PDU Run 8 pertain to the following operating conditions:

Catalyst American Cyanamid HDS 1442A, 1/16" Extrudates (HRI 3830)

Period	3AB	11AB	20AB
Operating Conditions			
Hours of Run - Beginning	28.00	190.00	378.00
End	52.00	202.00	402.00
Catalyst Age (End Average) Lb Dry Coal/Lb	274.2	867.6	1320.2
Catalyst Added, Cumulative*			
Lbs/Ton Dry Coal	.54	1.00	.63
Coal Feed (Dry), Lb/Hr/Cu.ft. Reactor Volume	74.69	77.51	49.25
Average Reactor Temperature, °F	846.	849.	850.
Unit Back Pressure (Unit BP), psig	2688.	2584.	2631.
H2 Partial Pressure, psia	1726.	1756.	1874.
Oil/Solid Ratio (Slurry Tank), Lb/Lb Solids	1.92	1.77	1.72
H2 Inlet Rate, MSCF/Ton Dry Coal	36.56	35.60	50.69
Recycle Gas, MSCF/Ton Dry Coal	21.60	20.90	33.47
Catalyst Inventory, End, Lbs	50.81	51.27	48.89
Catalyst Added, Lbs	3.94	0.00	0.00
Catalyst Withdrawn, Lbs *	4.28	0.00	5.84
Catalyst Age (End), Lb Dry Coal/Lb			
Average (Basis)	274.2	867.6	1320.2
Original Charge (Basis)	288.4	1193.0	2265.9
Catalyst Added, Cumulative†			
Lbs/Ton Dry Coal	.54	1.00	.63
Catalyst Withdrawals			
Withdrawal, Oil Laden, Lbs	8.53	0.00	10.86
Oil, Wt %	31.21		23.24
Molybdenum (Oil Free), Wt %*	7.26		6.97
Coal Feed (Dry)			
Lbs/Hr/Cu Ft Reactor Volume	74.69	77.51	49.25
Moisture Wt % (Coal Sample)	3.60	4.48	2.02
Ash, Wt % (Dry Coal)	10.84	10.87	10.87
Recycle Flows, Lbs/Lb Solids			
Atmospheric Still Bottoms	.76	.52	.34
Vacuum Still Overhead	.35	.33	.31
Inventory Change	.05	-.05	-.01
Hydroclone Overflow (Oil)	.86	.88	1.04
Make-up Oil	0.00	0.00	.02
TOTAL	1.92	1.77	1.72

Temperature, °F			
Coal Preheater Outlet	734.	788.	798.
Reactor Liquid Phase, Avg.	846.	849.	850.
Max.	860.	857.	856.
Separator-2" (@ 12" Skin)	829.	829.	800.
Hydroclone Overflow	499.	506.	468.
Vacuum Still Flash Zone	521.	514.	534.
Pressure			
Unit Back Pressure, psig	2688.	2584.	2631.
Hydrogen Make-up, psig	2815.	2727.	2738.
Hydrogen Partial Pressure, psia (Reactor Outlet - Separator)	1726.	1756.	1874.
Vacuum Flash, Torr	4.	3.	2.
Recycle Gas, MSCF/Ton Dry Coal	21.60	20.90	33.47
Vent Gas, MSCF/Ton Dry Coal	4.39	3.89	6.07
Hydrogen Purity of Recycle Gas and Vent, %	85.99	88.06	88.35
Total H2, MSCF/Ton Dry Coal (Reactor Outlet)	24.29	24.16	36.88
Hydrogen, Make-up + Recycle			
MSCF/Ton Dry Coal	36.56	35.60	50.69
Partial Pressure, psia (Inlet)	2614.	2562.	2557.
Hydrogen Consumption (1)			
MSCF/Ton Dry Coal	12.26	11.44	13.81
Wt % Dry Coal	3.26	3.04	3.67
Oil Additions			
Make-up Oil, Lbs/Lb Dry Coal	0.00	0.00	.02
Lbs/Hr/Cu Ft Reactor	0.00	0.00	.94
Flush Oil, Lbs/Lb Dry Coal	.002	.002	.004

Explanatory Notes

*10.30 wt % molybdenum is fresh catalyst

†Catalyst addition rate was changed at the beginning of Period 19. The cumulative total was set to zero at the beginning of Period 19.

3. Data cited for Reference 156 for H-Coal PDU Run 9 pertain to the following operating conditions:

Catalyst American Cyanamid HDS 1442A, 1/16" Extrudates (HRI 3830)

Period	6AB	12AB	18AB	23AB	28AB
Operating Conditions					
Hours of Run - Beginning	119.00	263.00	407.00	527.00	647.00
End	143.00	287.00	431.00	551.00	671.00
Catalyst Age (End Average), Lb Dry Coal/Lb	282.0	548.6	769.8	906.0	999.7
Catalyst Added, Cumulative Lbs/Ton Dry Coal	1.20	1.10	1.05	1.07	1.12
Coal Feed (Dry), Lb/Hr/Cu.ft. Reactor Volume	31.84	32.18	31.32	31.51	31.88
Average Reactor Temperature, °F	848.	850.	851.	849.	850.
Unit Back Pressure (Unit BP), psig	2703.	2696.	2684.	2681.	2701.
H2 Partial Pressure, psig	1725.	1862.	1751.	1787.	1765.
Oil/Solid Ratio (Slurry Tank), Lb/Lb Solids	1.70	1.71	1.67	1.74	1.66
H2 Inlet Rate, MSCF/Ton Dry Coal	57.92	56.22	55.00	54.28	55.31
Recycle Gas, MSCF/Ton Dry Coal	37.70	36.40	37.00	37.41	36.82
Catalyst Inventory, End, Lbs	102.40	103.47	106.61	108.93	110.50
Catalyst Added, Lbs	7.15	3.57	4.50	2.10	3.90
Catalyst Withdrawn, Lbs *	5.16	3.43	3.48	1.98	3.14
Catalyst Age (End), Lb Dry Coal/Lb					
Average (Basis)	282.0	548.6	769.8	906.0	999.7
Original Charge (Basis)	315.3	653.2	974.1	1236.1	1493.3
Catalyst Added, Cumulative Lbs/Ton Dry Coal	1.20	1.10	1.05	1.07	1.12
Catalyst Withdrawals					
Withdrawal, Oil Laden, Lbs	10.90	7.29	7.37	4.22	7.55
Oil, Wt %	30.39	32.86	26.55	24.49	34.40
Molybdenum (Oil Free), Wt %*	7.01	7.22	6.63	6.40	6.53
Coal Feed (Dry)					
Lbs/Hr/Cu Ft Reactor Volume	31.84	32.18	31.32	31.51	31.88
Moisture Wt % (Coal Sample)	1.69	1.44	1.64	1.71	1.57
Ash, Wt % (Dry Coal)	9.42	8.28	8.65	6.88	7.40
Recycle Flows, Lbs/Lb Solids					
Atmospheric Still Bottoms	.24	.29	.39	.26	.33
Vacuum Still Overhead	.23	.25	.22	.27	.12
Inventory Change	-.01	-.02	.05	-.12	-.02
Hydroclone Overflow (Oil)	1.22	1.19	1.11	1.21	1.19
Make-up Oil	0.00	0.00	0.00	0.00	0.00
TOTAL	1.70	1.71	1.67	1.74	1.66

Temperature, °F					
Coal Preheater Outlet	708.	719	741.	751.	773.
Reactor Liquid Phase, Avg.	848.	850.	851.	849.	850.
Max.	853.	854.	854.	854.	856.
Separator-2" (@ 12" Skin)	804.	805.	783.	767.	770.
Hydroclone Overflow	502.	502.	500.	496.	489.
Vacuum Still Flash Zone	531.	543.	541.	543.	544.
Pressure					
Unit Back Pressure, psig	2703.	2696.	2684.	2681.	2701.
Hydrogen Make-up, psig	2882.	2901.	2888.	2933.	2939.
Hydrogen Partial Pressure, psia (Reactor Outlet - Separator)	1874.	1915.	1854.	1897.	1849.
Vacuum Flash, Torr	4.	2.	2.	1.	1.
Recycle Gas, MSCF/Ton Dry Coal	37.70	36.40	37.00	37.41	36.82
Vent Gas, MSCF/Ton Dry Coal	5.94	6.09	6.33	6.53	6.73
Hydrogen Purity of Recycle Gas and Vent, %	84.65	85.05	83.11	84.01	83.30
Total H2, MSCF/Ton Dry Coal (Reactor Outlet)	38.89	38.57	37.95	38.64	38.00
Hydrogen, Make-up + Recycle					
MSCF/Ton Dry Coal	57.92	56.22	55.00	54.28	55.31
Partial Pressure, psia (Inlet)	2635.	2659.	2607.	2655.	2658.
Hydrogen Consumption (1)					
MSCF/Ton Dry Coal	19.03	17.66	17.05	15.64	17.30
Wt % Dry Coal	5.05	4.69	4.53	4.15	4.59
Chemical Hydrogen Consumption					
MSCF/Ton Dry Coal	18.23	17.26	16.68	16.21	15.79
Oil Additions					
Make-up Oil, Lbs/Lb Dry Coal	0.00	0.00	0.00	0.00	0.00
Lbs/Hr/Cu Ft Reactor	0.00	0.00	0.00	0.00	0.00
Flush Oil, Lbs/Lb Dry Coal	.003	.003	.003	.003	.003

Explanatory Notes

*10.30 wt % molybdenum is fresh catalyst

4. The following benzo(a)pyrene concentrations have been determined in H-Coal intermediates derived from the H-Coal PDU (Reference 161):

DOE Sample No.	Intermediate	Mode of Operation	Concentration (Mg/g)
1308	atmospheric still overhead	syncrude	0.3
1309	atmospheric still bottoms	syncrude	115±8
1310	vacuum still overhead	syncrude	451
1311	vacuum still bottoms	syncrude	233±14
1312	atmospheric still overhead	fuel oil	5
1313	atmospheric still bottoms	fuel oil	37
1314	vacuum separator overhead	fuel oil	260
1315	vacuum still bottoms	fuel oil	142

5. The following nitrogen-containing compound types have been identified in a basic chromatographic fraction of SRC-I process solvent from the SRC-I Ft. Lewis pilot plant (Reference 159): quinolines, benzoquinolines, azapyrenes, aminonaphthalenes, aminoanthracenes, aminophenanthrene, and aminopyrenes.

6. The following 2-aminonaphthalene concentrations have been determined in H-Coal intermediates derived from the H-Coal PDU, syncrude mode (Reference 160): atmospheric still overhead (DOE Sample No. 1308), 18±7 ug/g; atmospheric still bottoms (DOE Sample No. 1309), 13±2 ug/g; vacuum still overhead (DOE Sample No. 1310), 18±5 ug/g; and vacuum still bottoms (DOE Sample No. 1311), 5±2 ug/g.

7. The following values (wt %) were obtained for SRC-I process solvent from the Wilsonville pilot plant using alumina column chromatography (Reference 127):

Distillation Fraction	600-650°F	650-700°F	700-750°F	750-800°F	800-850°F
Aliphatic hydrocarbons	40 ± 7	35 ± 11	26 ± 15	19 ± 10	5 ± 5
Nitrogen-containing polycyclic aromatic compounds	9 ± 6	19 ± 9	21 ± 8	22 ± 8	35 ± 7
Neutral polycyclic aromatic hydrocarbons	32 ± 6	30 ± 8	31 ± 5	30 ± 5	20 ± 3
Hydroxy polycyclic aromatic hydrocarbons	6 ± 6	9 ± 5	10 ± 8	14 ± 4	25 ± 3

Part VIII. NAPHTHAS

Table 224. Specific Gravity

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	0.8408*	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	0.8338*	Wilsonville pilot plant, SRC unit, (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	0.7958*	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis, (Run No. 220, APCI Sample No. 1933CB)	82
		KY No. 9 and 14	0.934	Ft. Lewis pilot plant†	83
	SRC-II	Powhattan No. 5	0.7809‡	Ft. Lewis pilot plant (UOP Sample No. 3777-1)	85
	EDS	IL No. 6 (Monterey Mine)	0.8328‡	One tpd pilot plant; once-through mode (UOP Sample No. 3531-7)	87
		IL No. 6	0.8275	One tpd pilot plant; once-through mode (SWRI Sample No. G-C2)	90
		IL No. 6	0.8258	One tpd pilot plant, from "typical" run (Run A-7)	99
		IL No. 6 (Monterey Mine)	0.83 ± 0.01	One tpd pilot plant; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	0.83 ± 0.01	One tpd pilot plant; operating conditions: 840°F reactor temperature, 40 minutes residence time, average of ten yield periods	99

(Continued)

Table 224 (Continued)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw naphtha	EDS	IL No. 6 (Monterey Mine)	0.82 ± 0.01	75 lb per day development unit; average of six operating conditions (800-880°F reactor temperature; 25-100 minutes residence time)	99
		IL No. 6 (Monterey Mine)	0.82 ± 0.00	75 lb per day development unit; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of 21 yield periods	99
		Wyodak	0.8150	One tpd pilot plant, from "typical" run (Run A-7)	99
		Wyodak	0.8438	One tpd pilot plant, once-through mode (SWRI Sample No. G-C3)	90
		Wyodak	0.82 ± 0.01	One tpd pilot plant; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	0.81 ± 0.01	One tpd pilot plant; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
		Wyodak	0.82 ± 0.02	75 lb per day development unit; average of eight operating conditions (800-880°F reactor temperature; 25-100 minutes residence time)	99
		Wyodak	0.82 ± 0.00	75 lb per day development unit; operating conditions: 880°F reactor temperature, 25 minutes residence time; average of 6 yield periods	99

(Continued)

Table 224 (Continued)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw naphtha	H-Coal	IL No. 6	0.8076[‡]	PDU, syncrude mode; rerun naphtha (UOP Sample No. 3531-1-2)	92
		IL No. 6 (Burning Star Mine)	0.864	Derived from PDU atmospheric still overhead and vacuum still overhead streams, fuel oil mode (analyzed by BETC)[§]	97
		IL No. 6 (Monterey Mine)	0.838	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)[§]	97
Hydrotreated coal naphtha	SRC-II	Powhattan No. 5	0.7711[‡]	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3777-1 (UOP Sample No. 3777-2, UOP Research Plant 505, Run 874)	85
	EDS	IL No. 6 (Monterey Mine)	0.8058[‡]	Bench-scale continuous hydrotreating of UOP Sample No. 3531-7 coal raw naphtha, moderate severity hydrotreatment (UOP Sample No. 3531-12, UOP Research Plant 629, Run 218); operating conditions: LHSV/LHSV base , 0.125 P-P (base), 450 psig, T-T (base), 33°C	87
	H-Coal	IL No. 6	0.7936[‡]	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-1-2 moderate severity hydrotreatment (UOP Sample No. 3531-4, UOP Research Plant 629, Run 215). Operating conditions: LHSV/LHSV, 0.125; P-P (base), 450 psig	92

(Continued)

Table 224 (Continued)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal-derived gasoline	SRC-II	Powhattan No. 5	0.8090 (Period 1)[‡,#] 0.8151 (Period 2) 0.8109 (Period 4) 0.8299 (Period 5) 0.8123 (Period 6)	Bench-scale continuous platforming of hydrotreated coal naphtha Sample No. 3777-2 (UOP Research Plant 636, Run 335)[**]	85
	EDS	IL No. 6 (Monterey Mine)	0.8576 (Period 1)[‡,#] 0.8504 (Period 2) 0.8483 (Period 3) 0.8443 (Period 4) 0.8393 (Period 5) 0.7475 (Period 6) 0.8363 (Period 7) 0.8529 (Period 8) 0.8623 (Period 9) 0.8735 (Period 10)	Bench-scale continuous platforming of moderate hydrotreated coal naphtha Sample No. 3531-12 (UOP Research Plant 508, Run 1456)[††]	87

(Continued)

Table 224 (Concluded)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal derived gasoline	H-Coal	IL No. 6	0.8448 (Period 1)[‡,#] 0.8483 (Period 2) 0.8458 (Period 4) 0.8403 (Period 5) 0.8418 (Period 6) 0.8373 (Period 7) 0.8358 (Period 8) 0.8338 (Period 10) 0.8565 (Period 14)	From bench-scale continuous platforming of moderately hydrotreated coal naphtha Sample No. 3531-4 (UOP Research Plant 636, Run No. 220)[‡‡]	92

Explanatory Notes

[*] Determined via ASTM D-1298

[†] See General Comments Section, Note 2, for summary of operating conditions used.

[‡] Measured at 60°F

[§] See General Comments Section, Note 3, for summary of operating conditions used.

[#] Each period refers to a run time having a characteristic set of operating conditions.

[**] See General Comments Section, Note 4, for summary of operating conditions used.

[††] See General Comments Section, Note 5, for summary of operating conditions used.

[‡‡] See General Comments Section, Note 6, for summary of operating conditions used.

Table 225. API Gravity

Material	Process	Coal Type	Value (degrees)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	36.8*,†	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	38.2*,†	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		NA	43.0	Wilsonville pilot plant	84
		KY No. 9	46.3*,†	Wilsonville pilot plant, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
	SRC-II	Powhattan No. 5	49.7†	Ft. Lewis pilot plant (UOP Sample No. 3777-1)	85
		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	36.2	Ft. Lewis pilot plant (Chevron Sample No. WOW 3750)	86
	EDS	IL No. 6 (Monterey Mine)	38.4†	One tpd pilot plant, once-through mode (UOP Sample No. 3531-7)	87
		IL No. 6	39.5	One tpd pilot plant; once-through mode (SWRI Sample No. G-C2)	90
		IL No. 6	39.9	One tpd pilot plant, from "typical" run (Run A-7)	99
		IL No. 6 (Monterey Mine)	39.8	One tpd pilot plant; operating conditions: 840°F reactor temperature, 40 minutes residence time, 1500 psi reactor pressure; average of yield period Nos. 256-265	99

(Continued)

Table 225 (Continued)

Material	Process	Coal Type	Value (degrees)	Sample Description/Source	Reference
Coal raw naphtha	EDS	IL No. 6 (Monterey Mine)	38.87 ± 1.61	One tpd pilot plant; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	39.85 ± 1.99	One tpd pilot plant; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6 (Monterey Mine)	42.0	One tpd pilot plant; operating conditions: 840°F reactor temperature, 25 minutes residence time; average of yield period Nos. 225-231	99
		IL No. 6 (Monterey Mine)	45.1	One tpd pilot plant, sample washed with caustic prior to analysis; operating conditions: 840°F reactor temperature, 25 minutes residence time; average of yield period Nos. 225-231	99
		IL No. 6 (Monterey Mine)	41.17 ± 3.32	75 lb per day development unit; average of six operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		IL No. 6 (Monterey Mine)	41.26 ± 2.07	75 lb per day development unit; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of 21 yield periods	99

(Continued)

Table 225 (Continued)

Material	Process	Coal Type	Value (degrees)	Sample Description/Source	Reference
Coal raw naphtha	EDS	Wyodak	42.1	One tpd pilot plant, from "typical" run (Run A-7)	99
		Wyodak	36.2	One tpd pilot plant, once-through mode (SWRI Sample No. G-C3)	90
		Wyodak	39.91 ± 2.08	One tpd pilot plant; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	42.17 ± 1.83	One tpd pilot plant; operating conditions: 840°F reactor temperature, 60 minutes residence time; average of seven yield periods	99
		Wyodak	43.0	One tpd pilot plant; operating conditions: 840°F reactor temperature, 60 minutes residence time; 1500 psi reactor pressure; average of yield period Nos. 267-270	99
		Wyodak	38.0	One tpd pilot plant; operating conditions: 840°F reactor temperature, 25, 40 and 60 minutes residence times; average of yield period Nos. 237, 244 and 249	99
		Wyodak	40.8	One tpd pilot plant, sample washed with caustic prior to analysis; operating conditions: 840°F reactor temperature; 25, 40 and 60 minutes residence times; average of yield period Nos. 237, 244 and 249	99

(Continued)

Table 225 (Continued)

Material	Process	Coal Type	Value (degrees)	Sample Description/Source	Reference
Coal raw naphtha	EDS	Wyodak	42.02 ± 2.47	75 lb per day development unit; average of eight operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		Wyodak	42.01 ± 0.60	75 lb per day development unit; operating conditions: 880°F reactor temperature, 25 minutes residence time; average of six yield periods	99
	H-Coal	IL No. 6	43.7[†]	PDU, syncrude mode, rerun naphtha (UOP Sample No. 3531-1-2)	92
		IL No. 6 (Burning Star Mine)	40.6	PDU (Ashland Oil sample)	96
		IL No. 6 (Burning Star Mine)	32.3	Derived from PDU atmospheric still overhead and vacuum still overhead streams, fuel oil mode (analyzed by BETC)[‡]	97
		IL No. 6 (Monterey Mine)	37.4	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)[‡]	97
		IL No. 6	35.0	PDU, syncrude mode	109
		Wyodak	43.9	PDU, syncrude mode	109
		W. KY No. 11	42.8	PDU, syncrude mode	109

(Continued)

Table 225 (Continued)

Material	Process	Coal Type	Value (degrees)	Sample Description/Source	Reference
Hydrotreated coal naphtha	SRC-II	Powhattan No. 5	52.0[†]	Bench-scale continuous hydrotreating of UOP coal raw naphtha, Sample No. 3777-1 (UOP Sample No. 3777-2, UOP Research Plant 505, Run 874)	85
		KY No. 9 and 14, IL No. 6, (River King Mine) and Pitt-Seam WV (Blackville No. 2 Mine)	46.9, 45.8	Ft. Lewis pilot plant, Chevron coal raw naphtha Sample No. WOW 3750 hydrotreated with ICR 113 catalyst (Run No. 65-194, Run Hours 111-135 and 231-255, respectively)[§]	86
		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seam WV (Blackville No. 2 Mine)	41.6	Ft. Lewis pilot plant, Chevron coal raw naphtha Sample No. SGQ 6502 partially hydrotreated with ICR 113 catalyst (Run No. 72-326)	86
		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Black-Ville No. 2 Mine)	42.2, 41.8	Ft. Lewis pilot plant, Chevron coal raw naphtha Sample No. SGQ 6502 partially hydrotreated and hydrofined with ICR 113 catalyst (Run No. 72-326, Run Hours 138-150 and 222-246, respectively)[#]	86

(Continued)

Table 225 (Continued)

Material	Process	Coal Type	Value (degrees)	Sample Description/Source	Reference
Hydrotreated coal naphtha	EDS	IL No. 6 (Monterey Mine)	44.1†	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-7, moderate severity hydrotreatment (UOP Sample No. 3531-12, UOP Research Plant 629, Run 218); operating conditons: LHSV/LHSV (base), 0.125, P-P (base), 450 psig, T-T (base), 33°C	87
		IL No. 6 (Monterey Mine)	47.3	From minimum severity hydrotreatment in six-train, fixed bed pilot unit, operating conditions: 238°F, reactor temperature ($T-T_{ref}$), treat gas rate, 120% of ref. value	99
		IL No. 6 (Monterey Mine)	47.1	From minimum severity hydrotreatment of caustic-washed sample in six-train, fixed bed pilot unit; operating conditions: 238°F reactor temperature ($T-T_{ref}$), treat gas rate, 120% of ref. value	99
		Wyodak	43.7	From minimum severity hydrotreatment in six-train, fixed bed pilot unit; operating conditions: 238°F reactor temperature ($T-T_{ref}$), treat gas rate, 120% of ref. value	99
		Wyodak	42.8	From minimum severity hydrotreatment of caustic-washed sample in six-train, fixed bed pilot unit; operating conditions: 238°F reactor temperature ($T-T_{ref}$), treat gas rate, 120% of ref. value	99

(Continued)

Table 225 (Continued)

Material	Process	Coal Type	Value (degrees)	Sample Description/Source	Reference
Hydrotreated coal naphtha	H-Coal	IL No. 6	46.8[†]	Bench-scale continuous hydrotreating of UOP raw coal naphtha Sample No. 3531-1-2, moderate severity hydrotreatment, (UOP Sample No. 3531-4, UOP Research Plant 629, Run 215) operating conditions: P-P (base), 450 psig, LHSV/LHSV (base), 0.125	92
Coal-derived gasoline	SRC-II	Powhattan No. 5	43.4 (Period 1)[†,**] 42.1 (Period 2) 43.0 (Period 4) 39.0 (Period 5) 42.7 (Period 6)	Bench-scale continuous platforming of hydrotreated coal naphtha Sample No. 3777-2 (UOP Research Plant 636, Run 335)[††]	85
	EDS	IL No. 6 (Monterey Mine)	33.5 (Period 1)[†**] 34.9 (Period 2) 35.3 (Period 3) 36.1 (Period 4) 37.1 (Period 5) 57.8 (Period 6) 37.7 (Period 7) 34.4 (Period 8) 32.6 (Period 9) 30.5 Period 10)	Bench-scale continuous platforming of moderately hydrotreated coal naphtha Sample No. 3531-12 (UOP Research Plant 508, Run 1456)[††]	87
		NA	43.9	NA	88

(Continued)

Table 225 (Concluded)

Material	Process	Coal Type	Value (degrees)	Sample Description/Source	Reference
Coal-derived gasoline	H-Coal	IL No. 6	36.0 (Period 1)[†,**] 35.3 (Period 2) 35.8 (Period 4) 36.9 (Period 5) 36.6 (Period 6) 37.5 (Period 7) 37.8 (Period 8) 38.2 (Period 10) 33.7 Period 14)	Bench-scale continuous platforming of moderately hydrotreated coal naphtha Sample No. 3531-4 (UOP Research Plant 636, Run 220)[§§]	92

Explanatory Notes

[*] Determined via ASTM D-1298

[†] Measured at 60°F

[‡] See General Comments Section, Note 3, for summary of operating conditions used.

[§] See General Comments Section, Note 7, for summary of operating conditions used.

[#] See General Comments Section, Note 8, for summary of operating conditions used.

[**] Each period refers to a run time having a characteristic set of operating conditions used.

[††] See General Comments Section, Note 4, for summary of operating conditions used.

[‡‡] See General Comments Section, Note 5, for summary of operating conditions used.

[§§] See General Comments Section, Note 6, for summary of operating conditions used.

Table 226. Density

Material	Process	Coal Type	Value (g/ml)	Sample Description/Source	Reference
Coal raw naphtha	SRC-II	IL No. 6	0.8529 (77°F)	Ft. Lewis pilot plant, (DuPont "Notebook" Sample No. 16928)	91
	EDS	IL No. 6	0.87*	NA	89
		NA	0.8242 (77°F)	One tpd pilot plant (DuPont "Notebook" Sample No. 16928)	91
Hydro-treated coal naphtha	EDS	IL No. 6	0.80*	NA	89
Coal-derived gasoline	NA	--	--	--	--

Explanatory Notes

*Excludes the C_6/158°F naphtha cut

Table 227. Reid Vapor Pressure

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	3.6 (psia)*	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	4.35 (psia)*	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	1.75 (psia)*	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
	EDS	IL No. 6	3.3 (psi)	One tpd pilot plant; once-through mode (SWRI Sample No. G-C2)	90
		Wyodak	2.8 (psi)	One tpd pilot plant; once-through mode (SWRI Sample No. G-C3)	90
	H-Coal	IL No. 6	2.4 (psi)	PDU, syncrude mode	109
		Wyodak	2.5 (psi)	PDU, syncrude mode	109
		W.KY No. 11	2.0 (psi)	PDU, syncrude mode	109
Hydro-treated coal naphtha	NA	--	--	--	--
Coal-derived gasoline	NA	--	--	--	--

Explanatory Notes

*Determined via ASTM D-323

Table 228. Distillation Data

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	117°F-IBP*	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
			180°F-10		
			NA -15		
			217°F-20		
			237°F-30		
			260°F-40		
			286°F-50		
			308°F-60		
			326°F-70		
			344°F-80		
			360°F-90		
			380°F-EP		
		KY No. 9	116°F-IBP*	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
			169°F-10		
			185°F-15		
			218°F-20		
			246°F-30		
			268°F-40		
			288°F-50		
			306°F-60		
			332°F-70		
			352°F-80		
			365°F-90		
			389°F-EP		

(Continued)

Table 228 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	NA	118°F-IBP* 158°F-5 182°F-10 228°F-30 266°F-50 305°F-70 357°F-90 NA -95 425°F-EP	Wilsonville pilot plant	84
		KY No. 9	136°F-IBP* 196°F-10 NA -15 218°F-20 238°F-30 257°F-40 279°F-50 303°F-60 324°F-70 345°F-80 364°F-90 399°F-EP	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
		KY No. 9 and 14	166°F-IBP 344°F-50 500°F-EP	Ft. Lewis pilot plant‡	83
	SRC-II	Powhattan No. 5	107°F-IBP* 134°F-5 157°F-10 188°F-20 209°F-30 226°F-40 243°F-50 261°F-60 279°F-70 292°F-80 316°F-90 346°F-95 367°F-EP§	Ft. Lewis pilot plant (UOP Sample No. 3777-1)	85

(Continued)

Table 228 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw naphtha	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	151/179°F-IBP/5* 197/249°F-10/30 290°F-50 332/336°F-70/90 380/393°F-95/EP#	Ft. Lewis pilot plant (Chevron Sample No. WOW 3750)	86
	EDS	IL No. 6 (Monterey Mine)	142°F-IBP* 178°F-10 208°F-15 244°F-20 268°F-30 286°F-40 302°F-50 316°F-60 319°F-70 339°F-80 348°F-90 ND -95 380°F-EP	One tpd pilot plant, once-through mode (UOP Sample No. 3531-7)	87
		IL No. 6	125°F-5 305°F-50 389°F-95	One tpd pilot plant, from "typical" run (Run A-7)	99
		IL No. 6	223°F-10** 356°F-50 390°F-90	NA	89
		IL No. 6	127°F-IBP 201°F-10 239°F-20 298°F-50 347°F-90 369°F-EP#	One tpd pilot plant, once-through mode (SWRI Sample No. G-C2)	90

(Continued)

Table 228 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw naphtha	EDS	IL No. 6 (Monterey Mine)	160/200°F-IBP/5* 212/233°F-10/20 253/272°F-30/40 284/300°F-50/60 314/328°F-70/80 340/350°F-90/95 382-EP	One tpd pilot plant; operating conditions: 840°F reactor temperature, 25 minutes residence time; average of yield period Nos. 225-231	99
		IL No. 6 (Monterey Mine)	148/192°F-IBP/5* 212/233°F-10/20 248/265°F-30/40 278/295°F-50/60 312/325°F-70/80 340/350°F-90/95 410°-EP	One tpd pilot plant, sample washed with caustic prior to analysis; operating conditions: 840°F reactor temperature, 25 minutes residence time; average of yield period Nos. 225-231	99
		Wyodak	129°F-IBP 207°F-10 250°F-20 320°F-50 365°F-90 388°F-EP††	One tpd pilot plant, once-through mode (SWRI Sample No. G-C3)	90
		Wyodak	101°F-5 286°F-50 378°F-95	One tpd pilot plant, from "typical" run (Run A-7)	99

(Continued)

Table 228 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw naphtha		Wyodak	147/200°F-IBP/5* 212/245°F-10/20 270/288°F-30/40 312/328°F-50/60 342/351°F-70/80 362/372°F-90/95 411°F-EP	One tpd pilot plant, operating conditions: 840°F reactor temperature, 25, 40 and 60 minute residence times; average of yield period Nos. 237, 244 and 249	99
		Wyodak	138/190°F-IBP/5* 211/238°F-10/20 262/284°F-30/40 304/322°F-50/60 340/356°F-70/80 371/389°F-90/95 450°F-EP	One tpd pilot plant, sample washed with caustic prior to analysis; operating conditions: 840°F reactor temperature, 25, 40 and 60 minutes residence times; average of yield period Nos. 237, 244 and 249	99
	H-Coal	IL No. 6	132°F-IBP 170°F-5 189°F-10 215°F-20 233°F-30 251°F-40 260°F-50 292°F-60 312°F-70 328°F-80 351°F-90 373°F-95 396°F-EP‡‡	PDU; syncrude mode; rerun naphtha (UOP Sample No. 3531-1-2)	92

(Continued)

Table 228 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw naphtha	H-Coal	IL No. 6 (Burning Star Mine)	196°F-IBP 215°F-5 228°F-10 250°F-20 270°F-30 292°F-40 312°F-50 332°F-60 350°F-70 366°F-80 380°F-90 394°F-95	PDU (Ashland Oil sample)	96
		IL No. 6	142°F-IBP* 192°F-5 217°F-10 241°F-20 282°F-30 291°F-40 318°F-50 339°F-60 355°F-70 369°F-80 384°F-90 393°F-95 402°F-EP	PDU, syncrude mode	109
Hydro-treated coal naphtha	SRC-I	KY No. 9	187°F-IBP* 219°F-10 NA -15 227°F-20 234°F-30 NA -40 252°F-50 NA -60 311°F-70 336°F-80 364°F-90 413°F-EP	Wilsonville pilot plant (APCI Sample No. 1934CB)	82

(Continued)

Table 228 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Hydrotreated coal naphtha	SRC-II	Powhattan No. 5	136°F-IBP* 168°F-5 180°F-10 196°F-20 209°F-30 220°F-40 233°F-50 249°F-60 270°F-70 289°F-80 311°F-90 330°F-95 388°F-EP§§	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3777-1 UOP Sample No. 3777-2 (UOP Research Plant 505, Run 874)	85
		KY No. 9 and 14, IL No. 6, (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	166/188; 175/198°F-IBP/5* 200/240; 205/236°F-10/30 260/261°F-50 297/356; 306/366°F-70/90 385/428; 389/420°F-95/EP	Ft. Lewis pilot plant, Chevron coal raw naphtha Sample No. WOW 3750 hydrotreated with ICR 113 catalyst (Run No. 65-194, Run Hours 111-135 and 231-255, respectively)	86
		KY No. 9 and 14, IL No. 6, (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	200/216°F-IBP/5* 228/255°F-10/30 286-50 321/364-70/90 382/408-95/EP	Ft. Lewis pilot plant, Chevron coal raw naphtha Sample No. SGQ 6502 partially hydrotreated with ICR 113 catalyst (Run No. 72-326)	86
		KY No. 9 and 14, IL No. 6, (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	206/214°F-IBP/5* 231/258°F-10/30 290-50 327/370-70/90 384/415-95/EP##	Ft. Lewis pilot plant Chevron coal raw naphtha Sample No. SGQ 6502 partially hydrotreated and hydrofined with ICR 113 catalyst (Run No. 72-326, Run Hours 222-246)***	86

(Continued)

Table 228 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Hydrotreated coal naphtha	EDS	IL No. 6 (Monterey Mine)	202°F-IBP* 215°F-5 226°F-10 237°F-20 250°F-30 264°F-40 287°F-50 305°F-60 322°F-70 336°F-80 351°F-90 360°F-95 374°F-EP	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-7, moderate severity hydrotreatment (UOP Sample No. 3531-12, UOP Research Plant 629, Run 218) operating conditions: LHSV/LHSV (base), 0.125, P-P(base), 450 psig, T-T(base), 33°C	87
		IL No. 6 (Monterey Mine)	144/203°F-IBP/5* 210/225°F-10/20 238/253°F-30/40 268/289°F-50/60 306/322°F-70/80 338/352°F-90/95	From minimum severity hydrotreatment in six-train, fixed bed pilot unit; operating conditions: 238°F reactor temperature ($T-T_{ref}$), treat gas rate, 120% of ref. value	99
		IL No. 6 (Monterey Mine)	157/204°F-IBP/5* 214/233°F-10/20 246/262°F-30/40 278/293°F-50/60 309/324°F-70/80 341/350°F-90/95	From minimum severity hydrotreatment of caustic washed sample in six-train, fixed bed pilot unit; operating conditions: 238°F reactor temperature ($T-T_{ref}$), treat gas rate, 120% of ref. value	99
		IL No. 6	198°F-10 315°F-50 360°F-90	NA	89

(Continued)

Table 228 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Hydrotreated coal naphtha	EDS	Wyodak	148-192°F-IBP/5* 205/221°F-10/20 246/266°F-30/40 289/313°F-50/60 333/350°F-70/80 364/371°F-90/95	From minimum severity hydrotreatment in six-train, fixed bed pilot unit; operating conditions: 238°F reactor temperature ($T-T_{ref}$), treat gas rate, 120% of ref. value	99
		Wyodak	161/212°F-IBP/5* 226/247°F-10/20 268/287°F-30/40 306/329°F-50/60 343/357°F-70/80 371/389°F-90/95	From minimun severity hydrotreatment of caustic washed sample in six-train, fixed bed pilot unit; operating conditions: 238°F reactor temperature ($T-T_{ref}$), treat gas rate, 120% of ref. value	99
	H-Coal	IL No. 6	153°F-IBP* 185°F-5 199°F-10 217°F-20 231°F-30 246°F-40 263°F-50 284°F-60 306°F-70 329°F-80 352°F-90 367°F-95 393°F-EP‡‡	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-1-2, moderate severity hydrotreatment (UOP Sample No. 3531-4, UOP Research Plant 629, Run 215) operating conditions: LHSV/LHSV, 0.125, P-P (base), 450 psig	92

(Continued)

Table 228 (Continued)

Material	Process	Coal Type	Value (% Evaporation)					Sample Description/Source	Reference
Coal-derived gasoline	SRC-II	Powhatan No. 5	Period 1 *,†	Period 2 *,†	Period 4 *,†	Period 5 *,†	Period 6 *,†	Bench-scale continuous platforming of hydrotreated coal naphtha Sample No. 3777-2 (UOP Research Plant 636, Run 336)†††	85
			152°F-IBP 172°F-5 182°F-10 212°F-30 244°F-50 280°F-70 322°F-90 343°F-95 396°F-EP	158°F-IBP 173°F-5 183°F-10 209°F-30 247°F-50 282°F-70 330°F-90 359°F-95 411°F-EP	154°F-IBP 172°F-5 182°F-10 212°F-30 246°F-50 285°F-70 327°F-90 351°F-95 380°F-EP	150°F-IBP 171°F-5 181°F-10 212°F-30 246°F-50 284°F-70 329°F-90 348°F-95 398°F-EP	151°F-IBP 171°F-5 181°F-10 211°F-30 245°F-50 283°F-70 326°F-90 351°F-95 383°F-EP		
	EDS	IL No. 6 (Monterey Mine)	Period 1 *,†	Period 2 *,†	Period 3 *,†	Period 4 *,†	Period 5 *,†	Bench-scale continuous platforming of moderately hydrotreated coal naphtha Sample No. 3531-12, (UOP Research Plant 508, Run 1456)‡‡‡	87
			200°F-IBP 215°F-5 227°F-10 261°F-30 300°F-50 339°F-70 379°F-90 402°F-95 441°F-EP	190°F-IBP 212°F-5 226°F-10 260°F-30 296°F-50 334°F-70 372°F-90 387°F-95 423°F-EP	197°F-IBP 216°F-5 228°F-10 260°F-30 298°F-50 338°F-70 375°F-90 390°F-95 420°F-EP	190°F-IBP 212°F-5 223°F-10 255°F-30 290°F-50 332°F-70 368°F-90 383°F-95 410°F-EP	198°F-IBP 216°F-5 227°F-10 260°F-30 298°F-50 337°F-70 378°F-90 396°F-95 436°F-EP		
			Period 6 *,†	Period 7 *,†	Period 8 *,†	Period 9 *,†	Period 10 *,†		
			190°F-IBP 209°F-5 220°F-10 251°F-30 288°F-50 326°F-70 364°F-90 380°F-95 407°F-EP	202°F-IBP 219°F--5 229°F-10 261°F-30 298°F-50 338°F-70 375°F-90 393°F-95 452°F-EP	194°F-IBP 215°F-5 226°F-10 257°F-30 293°F-50 332°F-70 370°F-90 385°F-95 419°F-EP	198°F-IBP 219°F-5 231°F-10 264°F-30 303°F-50 343°F-70 388°F-90 409°F-95 460°F-EP	194°F-IBP 214°F-5 226°F-10 258°F-30 294°F-50 336°F-70 389°F-90 406°F-95 460°F-EP		
	H-Coal	IL No. 6	Period 1 *,†	Period 2 *,†	Period 4 *,†	Period 5 *,†		Bench-scale continuous platforming of moderately hydrotreated coal naphtha Sample No. 3531-4, (UOP Research Plant 636, Run 220)§§§	92
			161°F-IBP 188°F-5 201°F-10 238°F-30 272°F-50 311°F-70 367°F-90 393°F-95 462°F-EP	156°F-IBP 186°F-5 200°F-10 239°F-30 274°F-50 316°F-70 370°F-90 396°F-95 453°F-EP	165°F-IBP 191°F-5 202°F-10 240°F-30 276°F-50 318°F-70 370°F-90 391°F-95 444°F-EP	164°F-IBP 190°F-5 204°F-10 240°F-30 277°F-50 321°F-70 372°F-90 395°F-95 425°F-EP			
			Period 6 *,†	Period 7 *,†	Period 8 *,†	Period 10 * †	Period 14 *,†		
			166°F-IBP 188°F-5 201°F-10 237°F-30 274°F-50 310°F-70 358°F-90 397°F-95 452°F-EP	169°F-IBP 192°F--5 204°F-10 238°F-30 275°F-50 312°F-70 360°F-90 392°F-95 435°F-EP	160°F-IBP 188°F-5 201°F-10 237°F-30 272°F-50 312°F-70 367°F-90 387°F-95 438°F-EP	169°F-IBP 194°F-5 206°F-10 239°F-30 275°F-50 317°F-70 366°F-90 384°F-95 418°F-EP	162°F-IBP 188°F-5 204°F-10 241°F-30 276°F-50 317°F-70 372°F-90 394°F-95 452°F-EP		

(Continued)

Table 228 (Concluded)

Explanatory Notes

[*] Determined by ASTM D-86

[†] Each period refers to a run time (usually less than 20 hours total time) having a characteristic set of operating conditions.

[‡] See General Comments Section, Note 3, for summary of operating conditions used.

[§] 97.5% recovered

[#] 98% recovered, 1% residue, 1% loss

[**] Excludes the C_6/158°F naphtha cut

[††] 98.5% recovered, 1% residue, 0.5% loss

[‡‡] 99% recovered

[§§] 98.5% recovered

[##] 99% recovered, 1% residue

[***] See General Comments Section, Note 8, for summary of operating conditions used.

[†††] See General Comments Section, Note 4, for summary of operating conditions used.

[‡‡‡] See General Comments Section, Note 5, for summary of operating conditions used.

[§§§] See General Comments Section, Note 6, for summary of operating conditions used.

Table 229. GC Simulated Distillation Data

Material	Process	Coal Type	Boiling Point Range	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	31°F - IBP*	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
			161°F - 10		
			182°F - 15		
			205°F - 20		
			237°F - 30		
			273°F - 40		
			309°F - 50		
			338°F - 60		
			352°F - 70		
			372°F - 80		
			386°F - 90		
			400°F - 95		
			425°F - EP		
		KY No. 9	22°F - IBP	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
			161°F - 10		
			184°F - 15		
			209°F - 20		
			239°F - 30		
			281°F - 40		
			319°F - 50		
			339°F - 60		
			360°F - 70		
			374°F - 80		
			393°F - 90		
			404°F - 95		
			434°F - EP		
		KY No. 9	188°F - IBP*	Wilsonville pilot plant, Alcoa coker unit (APCI Sample No. 1899CB)	82
			271°F - 10		
			281°F - 15		
			285°F - 20		
			292°F - 30		
			324°F - 40		
			345°F - 50		
			366°F - 60		
			378°F - 70		
			387°F - 80		
			403°F - 90		
			414°F - 95		
			450°F - EP		
		NA	29°F - IBP*	Wilsonville pilot plant	84
			125°F - 5		
			155°F - 10		
			214°F - 30		
			266°F - 50		
			321°F - 70		
			369°F - 90		
			394°F - 95		
			471°F - EP		

(Continued)

Table 229 (Continued)

Material	Process	Coal Type	Boiling Point Range	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	84°F - IBP* 167°F - 10 188°F - 15 208°F - 20 235°F - 30 257°F - 40 285°F - 50 311°F - 60 337°F - 70 360°F - 80 388°F - 90 NA - 95 426°F - EP	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Black-ville No. 2 Mine)	53/153°F - IBP/5 173/235°F - 10/30 291°F - 50 345/395°F - 70/90 408/442°F - 95/99	Ft. Lewis pilot plant (Chevron Sample No. WOW 3750)	86
		NA	32/149°F - 6 149/347°F - 64 347/644°F - 31	Ft. Lewis pilot plant (DuPont "Notebook" Sample No. 16928)	91
	EDS	NA	32/149°F - 8 149/347°F - 59 374/644°F - 34	One tpd pilot plant, once-through mode (DuPont "Notebook" Sample No. 16928)	91
		IL No. 6 (Monterey Mine)	125°F - 5† 165°F - 10 214°F - 20 249°F - 30 280°F - 40 305°F - 50 327°F - 60 346°F - 70 365°F - 80 384°F - 90 390°F - 95 398°F - 99	One tpd pilot plant; operating conditions: 840°F reactor temperature, 40 minutes residence time, 1500 psi reactor pressure; average of yield period Nos. 256-265	99

(Continued)

Table 229 (Continued)

Material	Process	Coal Type	Boiling Point Range	Sample Description/Source	Reference
Coal raw naphtha	EDS	IL No. 6 (Monterey Mine)	162±43°F - 5 315±21°F - 50 381±8°F - 95	One tpd pilot plant, average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	125±11°F - 5 305±14°F - 50 389±10°F - 95	One tpd pilot plant; operating conditions: 800°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6 (Monterey Mine)	168±8°F - 5 310±15°F - 50 385±5°F - 95	75 lb per day development unit; average of six operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		IL No. 6 (Monterey Mine)	160±6°F - 5 315±8°F - 50 384±3°F - 95	75 lb per day development unit; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of 21 yield periods	99
		Wyodak	113±9°F - 5 302±20°F - 50 386±18°F - 95	One tpd pilot plant; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	101°F - 5 286±19°F - 50 378±16°F - 95	One tpd pilot plant; operating conditions: 840°F reactor temperature, 60 minutes residence time; average of 7 yield periods	99

(Continued)

Table 229 (Continued)

Material	Process	Coal Type	Boiling Point Range	Sample Description/Source	Reference
Coal raw naphtha	EDS	Wyodak	105°F - 5 150°F - 10 196°F - 20 220°F - 30 252°F - 40 276°F - 50 305°F - 60 331°F - 70 349°F - 80 364°F - 90 372°F - 95 386°F - 99	One tpd pilot plant; operating conditions: 840°F reactor temperature, 60 minutes residence time, 1500 psi reactor pressure; average of yield period Nos. 267-270	99
		Wyodak	159±21°F - 5 302±18°F - 50 389±11°F - 95	75 lb per day development unit; average of eight operating conditions (800-850°F reactor temperature, 25-100 minutes residence time)	99
		Wyodak	154±5°F - 5 293±6°F - 50 379±5°F - 95	75 lb per day development unit; operating conditions: 880°F reactor temperature, 25 minutes residence time; average of six yield periods	99
	H-Coal	IL No. 6	98°F - IBP* 167°F - 5 182°F - 10 215°F - 20 237°F - 30 280°F - 40 322°F - 50 347°F - 60 368°F - 70 388°F - 80 400°F - 90 407°F - 95 452°F - EP	PDU, syncrude mode	109

(Continued)

Table 229 (Continued)

Material	Process	Coal Type	Boiling Point Range	Sample Description/Source	Reference
Coal raw naphtha	H-Coal	IL No. 6	97°F - IBP*	PDU, syncrude mode	109
			160°F - 5		
			186°F - 10		
			216°F - 20		
			240°F - 30		
			268°F - 40		
			289°F - 50		
			319°F - 60		
			344°F - 70		
			366°F - 80		
			393°F - 90		
			402°F - 95		
			429°F - EP		
		W. KY No. 11	97°F - IBP*	PDU, syncrude mode	109
			155°F - 5		
			180°F - 10		
			204°F - 20		
			234°F - 30		
			260°F - 40		
			288°F - 50		
			315°F - 60		
			341°F - 70		
			369°F - 80		
			404°F - 90		
			432°F - 95		
			498°F - EP		

(Continued)

Table 229 (Continued)

Material	Process	Coal Type	Boiling Point Range	Sample Description/Source	Reference
Hydrotreated coal naphtha	SRC-I	KY No. 9	100°F - IBP* 182°F - 10 189°F - 15 209°F - 20 219°F - 30 234°F - 40 253°F - 50 284°F - 60 317°F - 70 351°F - 80 385°F - 90 404°F - 95 454°F - EP	Wilsonville pilot plant, (APCI Sample No. 1934CB)	82
	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	50/155°F 52/160°F - IBP/5 173/214°F; 175/217°F - 10/30 246°F; 256°F - 50 302/374°F; 308/377°F - 70/90 391/464°F; 399/451°F - 95/99	Ft. Lewis pilot plant, Chevron coal raw naphtha Sample No. WOW 3750 hydrotreated with ICR 113 catalyst (Run No. 65-194, run hours 111-135 and 23-255, respectively)‡	86
		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	135/184°F - IBP/5 216/260°F - 10/30 309°F - 50 359/406°F - 70/90 414/436°F - 95/99	Ft. Lewis pilot plant, Chevron coal raw naphtha Sample No. SGQ 6502 partially hydrotreated with ICR 113 catalyst (Run No. 72-326)	86

(Continued)

Table 229 (Concluded)

Material	Process	Coal Type	Boiling Point Range	Sample Description/Source	Reference
Hydrotreated coal naphtha	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	96/179°F; 101/182°F - IBP/5 197/242°F; 199/247°F - 10/30 289; 294 - 50 340/394; 345/399 - 70/90 407/435; 411/437 - 95/99	Ft. Lewis pilot plant, Chevron coal raw naphtha Sample No. SGQ 6502 partially hydrotreated and hydrofined with ICR 113 catalyst (Run No. 72-326, Run Hours 138-150 and 222-246, respectively)§	86
Coal-derived gasoline	NA	--	--	--	--

Explanatory Notes

*Determined via ASTM D-2887

†Average of inspections of unknown number of individual samples derived from a sequence of yield periods at "study design" conditions

‡See General Comments Section, Note 7, for summary of operating conditions used.

§See General Comments Section, Note 8, for summary of operating conditions used.

Table 230. Molecular Weight

Material	Process	Coal Type	Value (g/mole)	Sample Description/Source	Reference
Coal raw naphtha	SCR-II	KY No. 9 and 14 IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	118	Ft. Lewis pilot plant, (Chevron Sample No. WOW 3750)	86
Hydrotreated coal naphtha		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	119	Ft. Lewis pilot plant, Chevron coal raw naphtha Sample No. SGQ 6502 partially hydrotreated and hydrofined with ICR 113 catalyst (Run No. 72-326, Run hours 222-246)	86
Coal-derived gasoline		NA	--	--	--

Table 231. Total Acid Number

Material	Process	Coal Type	Value (mg KOH/g)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	6.08*	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	6.63*	Wilsonville pilot plant, SRC unit (Run No. 225; APCI Sample No. 1910CB)	82
		KY No. 9	6.26*	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
	H-Coal	IL No. 6	0.07	PDU, syncrude mode	109
		Wyodak	0.13	PDU, syncrude mode	109
		W. KY No. 11	0.19	PDU, syncrude mode	109
Hydrotreated coal naphtha	NA	--	--	--	--
Coal-derived gasoline	NA	--	--	--	--

Explanatory Notes

*Determined via ASTM D-664

Table 232. Gum Content

Material	Process	Coal Type	Value (mg/100 ml)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	47.0	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	107	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	38	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
	SRC-II	Powhattan No. 5	12.0	Ft. Lewis, pilot plant (UOP Sample No. 3777-1)	85
	EDS	IL No. 6 (Monterey Mine)	44.0	One tpd pilot plant, once-through mode (UOP Sample No. 3531-7)	87
		IL No. 6	145	One tpd pilot plant, once-through mode, unwashed (SWRI Sample No. G-C2)	90
		Wyodak	248	One tpd pilot plant, once-through mode, washed (SWRI Sample No. G-C3)	90
		IL No. 6	122	One tpd pilot plant, once-through mode, washed (SWRI Sample No. G-C2)	90
		Wyodak	258	One tpd pilot plant, once-through mode, unwashed (SWRI Sample No. G-C3)	90
	H-Coal	IL No. 6	40.0	PDU, syncrude mode; rerun naphtha, (UOP Sample No. 3531-1-2)	92
		IL No. 6	22	PDU, syncrude mode	109
		Wyodak	58	PDU, syncrude mode	109
		W. KY No. 11	47	PDU, syncrude mode	109

(Continued)

Table 232 (Concluded)

Material	Process	Coal Type	Value (mg/100 ml)	Sample Description/Source	Reference
Hydrotreated coal naphtha	SRC-I	KY No. 9	2	Wilsonville pilot plant, SRC unit (APCI Sample No. 1934CB)	82
	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	1.1	Ft. Lewis pilot plant, Chevron coal raw naphtha Sample No. WOW 3750 hydrotreated with ICR 113 catalyst (Run No. 65-194, Run Hours 111-135 and 231-255, respectively)*	86
Coal-derived gasoline	NA	--	--	--	--

Explanatory Notes

*See General Comments Section, Note 7, for summary of operating conditions used.

Table 233. Viscosity

Material	Process	Coal Type	Value (centi-stokes)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	1.304* (68°F) 0.960 (104°F) 0.754 (140°F)	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	1.172 (68°F) 0.8791* (104°F) 0.6858 (140°F)	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1918CB)	82
		NA	1.03 (50°F)	Wilsonville pilot plant	84
		KY No. 9	0.85 (68°F) 0.69* (104°F) 0.57 (140°F)	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
		KY No. 9 and 14	1.62 (centi-poise)	Ft. Lewis pilot plant†	83
	SCR-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Black-ville No. 2 Mine)	0.8933 (100°F)	Ft. Lewis pilot plant, (Chevron Sample No. WOW 3750)	86
	EDS	IL No. 6	0.9 (100°F) 0.5 (210°F)	One tpd pilot plant, from "typical" run (Run A-7)	99

(Continued)

Table 233 (Continued)

Material	Process	Coal Type	Value (centi-stokes)	Sample Description/Source	Reference
Coal raw naphtha	EDS	IL No. 6 (Monterey Mine)	0.85±0.03 (100°F) 0.47±0.03 (210°F)	One tpd pilot plant; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	0.87±0.06 (100°F) 0.50 (210°F)	One tpd pilot plant; operating conditions: 840°F reactor temperature; 40 minutes residence time; average of ten yield periods	99
		Wyodak	0.8 (100°F) 0.5 (210°F)	One tpd pilot plant, from "typical" run (Run A-7)	99
		Wyodak	0.86±0.07 (100°F) 0.47±0.03 (210°F)	One tpd pilot plant; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	0.82±0.07 (100°F) 0.46±0.01 (210°F)	One tpd pilot plant; operating conditions: 840°F reactor temperature, 60 minutes residence time; average of seven yield periods	99
	H-Coal	IL No. 6 (Burning Star Mine)	1.08* (100°F)	Derived from PDU atmospheric still overhead and vacuum still overhead streams, fuel oil mode (analyzed by BETC)‡	97
		IL No. 6 (Monterey Mine)	0.96* (100°F)	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)‡	97
		IL No. 6	0.950 (104°F)	PDU, syncrude mode	109

(Continued)

Table 233 (Concluded)

Material	Process	Coal Type	Value (centi-stokes)	Sample Description/Source	Reference
Coal raw naphtha	H-Coal	Wyodak	0.801 (104°F)	PDU, syncrude mode	109
		W. KY No. 11	0.701 (104°F)	PDU, syncrude mode	109
Hydro-treated coal naphtha	NA	--	--	--	--
Coal-derived gasoline	NA	--	--	--	--

Explanatory Notes

*Determined via ASTM D-445

†See General Comments Section, Note 7, for summary of operating conditions used.

‡See General Comments Section, Note 3, for summary of operating conditions used.

Table 234. Pour Point

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	<-80*	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	<-80*	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		NA	<-65.0	Wilsonville pilot plant	84
		KY No. 9	<-80*	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
	H-Coal	IL No. 6 (Burning Star Mine)	<5*	Derived from PDU atmospheric still overhead and vacuum still overhead streams, fuel oil mode (analyzed by BETC)†	97
		IL No. 6 (Monterey Mine)	<5*	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)†	97
		IL No. 6	<-65	PDU, syncrude mode	109
		Wyodak	<-65	PDU, syncrude mode	109
Hydrotreated coal naphtha	NA	--	--	--	--
Coal-derived gasoline	NA	--	--	--	--

Explanatory Note

*Determined via ASTM D-97

†See General Comments Section, Note 3, for summary of operating conditions used.

Table 235. Carbon Residue

Material	Process	Coal Type	Value (wt.%)	Sample Description/Source	Reference
Raw coal naphtha	SRC-I	KY No. 9	0.08*	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	0.01*	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		NA	<0.01*,†	Wilsonville pilot plant	84
Hydro-treated coal naphtha	NA	--	--	--	--
Coal-derived gasoline	NA	--	--	--	--

Explanatory Note

*Determined via ASTM D-189

†Conradson carbon residue

Table 236. Bottom Sediment and Water

Material	Process	Coal Type	Value (ml)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	<0.05*	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	<0.05*	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	<0.05*	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
Hydro-treated coal naphtha	NA	--	--	--	--
Coal-derived gasoline	NA	--	--	--	--

Explanatory Note

*Determined via ASTM D-1796

Table 237. Freeze Point

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	<-76	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	<-76	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	<-76	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
Hydrotreated coal naphtha	NA	--	--	--	--
Coal-derived gasoline	NA	--	--	--	--

Explanatory Note

*Determined via ASTM D-2386

Table 238. Flash Point

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	<-20*	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	<-20*	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		NA	<75.0	Wilsonville pilot plant	84
		KY No. 9	<0*	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
	EDS	IL No. 6	<70	One tpd pilot plant, from "typical" run (Run A-7)	99
		Wyodak	<70	One tpd pilot plant, from "typical" run (Run A-7)	99
Hydro-treated coal naphtha	NA	--	--	--	--
Coal-derived gasoline	NA	--	--	--	--

Explanatory Note

*Determined via ASTM D-96

Table 239. Smoke Point

Material	Process	Coal Type	Value (mm)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	14.7*	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	22*	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	12*	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
Hydro-treated coal naphtha	NA	--	--	--	--
Coal-derived gasoline	NA	--	--	--	--

Explanatory Note

*Determined via ASTM D-1322

Table 240. Heat of Combustion

Material	Process	Coal Type	Value (net, (Btu/lb)	Sample Description/Source	Reference
Coal raw naphtha*	SRC-I	KY No. 9	17,706†	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	17,825†	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	19,028†	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
		IL No. 6	18,597	PDU, syncrude mode	109
		Wyodak	19,350	PDU, syncrude mode	109
		W. KY No. 11	18,733	PDU, syncrude mode	109
	EDS	IL No. 6	19,600	One tpd pilot plant, from "typical" run (Run A-7)	99
		Wyodak	20,100	One tpd pilot plant, from "typical" run (Run A-7)	99
Hydrotreated coal naphtha	NA	--	--	--	--
Coal-derived gasoline	NA	--	--	--	--

Explanatory Note

*An additional value for the gross heat of combustion of an SRC-I, Wilsonville pilot plant sample is 19,000 Btu/lb (Ref. 84).

†Determined via ASTM D-240

Table 241. Aniline Point

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	55.8*	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	78.8*	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	71*	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
	SCR-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	56.4	Ft. Lewis pilot plant (Chevron Sample No. WOW 3750)	86
Hydrotreated coal naphtha	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	80.7, 79.0	Ft. Lewis pilot plant Chevron coal raw naphtha Sample No. WOW 3750 hydrotreated with ICR 113 catalyst (Run No. 65-194, Run Hours 111-135 and 231-255, respectively)†	86
		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	67.6	Ft. Lewis pilot plant, Chevron coal raw naphtha Sample No. SGQ 6502 partialy hydrotreated with ICR 113 catalyst (Run No. 72-326)	86

(Continued)

Table 241 (Concluded)

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Hydrotreated coal naphtha	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	72.8, 70.0	Ft. Lewis pilot plant, Chevron coal raw naphtha Sample No. SGQ 6502 partially hydrotreated and hydrofined with ICR 113 catalyst (Run No. 72-326, Run Hours 138-150 and 222-246, respectively)[†]	86
Coal-derived gasoline	NA	--	--	--	--

Explanatory Note

[*] Determined via ASTM D-611

[†] See General Comments Section, Note 7, for summary of operating conditions used.

Table 242. Bromine Number

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	107*	Wilsonville pilot plant, SRC unit (Run No. 220; APCI Sample No. 1896CB)	82
		KY No. 9	20.5*	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
	SRC-II	Powhattan No. 5	30.0	Ft. Lewis pilot plant (UOP Sample No. 3777-1)	85
		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	49,52	Ft. Lewis pilot plant (Chevron Sample No. WOW 3750)	86
	EDS	IL No. 6 (Monterey Mine)	39	One tpd pilot plant; once-through mode (UOP Sample No. 3531-7)	87
		IL No. 6 (Monterey Mine)	35.6 (cg/g)	One tpd pilot plant; operating conditions: 840°F reactor temperature, 25 minutes residence time; average of yield period Nos. 225-231	99
		IL No. 6 (Monterey Mine)	19.3 (cg/g)	One tpd pilot plant; sample washed with caustic prior to analysis; operating conditions: 840°F reactor temperature, 25 minutes residence time; average of yield period Nos. 225-231	99

(Continued)

Table 242 (Continued)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw naphtha	EDS	Wyodak	30.6 (cg/g)	One tpd pilot plant; operating conditions: 840°F reactor temperature; 25, 40 and 60 minute residence time; average of yield period Nos. 237, 244 and 249	99
		Wyodak	16.0 (cg/g)	One tpd pilot plant; sample washed with caustic prior to analysis; operating conditions: 840°F reactor temperature, 25, 40 and 60 minute residence time; average of yield period Nos. 237, 244 and 249	99
		IL No. 6	35.6	PDU, syncrude mode	109
		Wyodak	13.8	PDU, syncrude mode	109
		W. KY No. 11	25.1	PDU, syncrude mode	109
	H-Coal	IL No. 6	19.3	PDU; syncrude mode, rerun naphtha, (UOP Sample No. 3531-1-2)	92
Hydro-treated coal naphtha	SRC-I	KY No. 9	<0.1*	Wilsonville pilot plant (APCI Sample No. 1934CB)	82
	SRC-II	Powhattan No.5	101.0	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3777-1 (UOP Sample No. 3777-2, UOP Research Plant 505, Run 874)	85
	EDS	IL No. 6 (Monterey Mine)	124.0	Bench-scale continuous hydrotreating of moderate UOP coal raw naphtha Sample No. 3531-7, moderate severity hydrotreatment, (UOP Sample No. 3531-12, UOP Research Plant 629, Run 218); operating conditions: LHSV/LHSV (base), 0.125, P-P (base), 450 psig, T-T (base), 33°C	87

(Continued)

Table 242 (Concluded)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Hydrotreated coal naphtha	H-Coal	IL No. 6	296	Bench-scale continuous hydrotreating of moderate UOP coal raw naphtha Sample No. 3531-1-2, moderate severity hydrotreatment, (Sample No. 3531-4, UOP Research Plant 629, Run 215); operating conditions: P-P (base), 450 psig, LHSV/LHSV (base), 0.125	92
Coal-derived gasoline	NA	--	--	--	--

Explanatory Note

*Determined via ASTM D-1159

Table 243. Copper Strip Corrosion

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	4b*	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	4b*	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	4b*	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
	EDS	IL No. 6	4c	One tpd pilot plant once-through mode (SWRI Sample No. G-C2)	90
		Wyodak	1a	One tpd pilot plant once-through mode (SWRI Sample No. G-C3)	90
	H-Coal	IL No. 6	1b	PDU, syncrude mode	109
		Wyodak	1a	PDU, syncrude mode	109
		W. KY No. 11	1a	PDU, syncrude mode	109
Hydrotreated coal naphtha	NA	--	--	--	--
Coal-derived gasoline	NA	--	--	--	--

Explanatory Note

*Determined via ASTM D-130

Table 244. Moisture

Material	Process	Coal Type	Value (wt%)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	0.58*	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	1.04*	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	0.24*	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
Hydro-treated coal naphtha	NA	--	--	--	--
Coal-derived gasoline	NA	--	--	--	--

Explanatory Note

*Determined via ASTM D-1744 (Karl Fischer reagent method)

Table 245. Color

Material	Process	Coal Type	Value*	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	1.75 (between pale and dark yellow)	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	2.5 (between dark yellow and light amber)	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	0.0 (clear white)	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
	H-Coal	IL No. 6 (Burning Star Mine)	NPA6	Derived from PDU atmospheric still overhead and vacuum still overhead streams, fuel oil mode (analyzed by BETC)†	97
		IL No. 6 (Monterey Mine)	NPA4 1/2	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)†	97
Hydrotreated coal naphtha	NA	--	--	--	--
Coal-derived gasoline	NA	--	--	--	--

Explanatory Note

*Determined via ASTM D-1500

†See General Comments Section, Note 3, for summary of operating conditions used.

Table 246. Research Octane Number (RON, clear)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw naphtha	SRC-II	Powhattan No. 5	80.8	Ft. Lewis pilot plant (Sample No. 3777-1)	85
	EDS	IL No. 6 (Monterey Mine)	83.2	One tpd pilot plant, once-through mode (UOP Sample No. 3531-7)	87
		IL No. 6	78.7*	One tpd pilot plant, once-through mode (SWRI Sample No. G-C2)	90
		Wyodak	83.8†	One tpd pilot plant, once-through mode (SWRI Sample No. G-C3)	90
	H-Coal	IL No. 6	80.3	PDU,syncrude mode, rerun naphtha, (UOP Sample No. 3531-1-2)	92
Hydro-treated coal naphtha	SRC-II	Powhattan No. 5	70.9	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3777-1 (UOP Sample No. 3777-2, UOP Research Plant 505, Run 874)	85
		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	69.4, 69.2 (F-1, clear); 65.3, 65.3 (F-2, clear)	Ft. Lewis pilot plant; Chevron coal raw naphtha Sample No. WOW 3750 hydrotreated with ICR 113 catalyst (Run No. 65-194, Run Hours 111-135 and 231-255, respectively)‡	86
		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	74.4	Ft. Lewis pilot plant; Chevron coal raw naphtha Sample No. SGQ 6502 paritally hydrotreated with ICR 113 catalyst (Run No. 72-326)	86

(Continued)

Table 246 (Continued)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Hydro-treated coal naphtha	SRC-II	KY No. 9 and 14, (River King Mine) IL No. 6 and Pitt-Seams WV (Blackville No. 2 Mine)	70.5, 71.2 (F-1, clear); 65.2, NA (F-2, clear)	Ft. Lewis pilot plant; Chevron coal raw naphta Sample No. SGQ 6502 partially hydrotreated and hydrofined with ICR 113 catalyst (Run No. 72-326, Run Hours 138-150 and 222-246 respectively)	86
	EDS	IL No. 6 (Monterey Mine)	64.5 (clear)	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-7, moderate severity hydrotreatment (UOP Sample No. 3531-12, UOP Research Plant 629, Run 218); operating conditions: LHSV/LHSV(base),0.125; P-P(base) 450 psig; T-T(base), 33°C	87
	H-Coal	IL No. 6	66.8	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-1-2,, moderate severity hydrotreatment (UOP Sample No. 3531-4, UOP Research Plant 629, Run 215), operating conditions: P-P (base), 450 spig; LHSV/LHSV (base), 0.125	92
Coal-derived gasoline	SRC-II	Powhattan No. 5	88.5 (Period 1)# 94.5 (Period 2) 97.6 (Period 3) 92.6 (Period 4) 99.9 (Period 5) 93.8 (Period 6)	Bench-scale continuous platforming of hydrotreated coal naphtha Sample No. No. 3777-2 (UOP Research Plant 636, Run 335)**	85

(Continued)

Table 246 (Continued)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal-derived gasoline	EDS	IL No. 6 (Monterey Mine)	99.7 (Period 1)# 97.9 (Period 2) 95.9 (Period 3) 95.1 (Period 4) 92.1 (Period 5) 90.6 (Period 6) 90.4 (Period 7) 98.2 (Period 8) 101.5 (Period 9) 104.5 (Period 10)	Bench-scale continuous platforming of moderately hydrotreated coal naphtha Sample No. 3531-12 (UOP Research Plant 508, Run 1456)	87
		IL No. 6 (Monterey Mine)	105	From minimum severity hydrotreated sample, boiling range 160 to 390°F	99
			105	From minimum severity hydrotreated sample, boiling range 160 to 340°F	99
		Wyodak	100	From minimum severity hydrotreated sample, boiling range 160 to 370°F	99
			105	From minimum severity hydrotreated sample, boiling range 160 to 345°F	99
	H-Coal	IL No. 6	99.8 (Period 1)# 99.8 (Period 2) 98.7 (Period 4) 97.7 (Period 5)	Bench-scale continuous platforming of moderately hydrotreated coal naphtha Sample No. 3531-4 (UOP Research Plant 636, Run 220)‡‡	92

(Continued)

Table 246 (Concluded)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal-derived gasoline	H-Coal	IL No. 6	97.7 (Period 6) 96.0 (Period 7) 95.9 (Period 8) 94.4 (Period 9) 94.2 (Period 10) 100.9 (Period 11) 101.3 (Period 12) 102.3 (Period 13) 102.6 (Period 14)		

Explanatory Notes

*Motor octane number was 73.9

†Motor octane number was 77.6

‡See General Comments Section, Note 7, for summary of operating conditions used.

§See General Comments Section, Note 8, for summary of operating conditions used.

#Each period refers to a run time having a characteristic set of operating conditions.

**See General Comments Section, Note 4, for summary of operating conditions used.

††See General Comments Section, Note 5, for summary of operating conditions used.

‡‡See General Comments Section, Note 6, for summary of operating conditions used.

Table 247. Oxygen Content

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	3.96	Wilsonville pilot plant SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	4.45	Wilsonville pilot plant SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	0.29	Wilsonville pilot plant, SRC unit sample washed with caustic prior to analysis, (Run No. 220, APCI Sample No. 1933CB)	82
		KY No. 9	3.96	Wilsonville pilot plant, Alcoa coker unit (APCI Sample No. 1899CB)	82
		NA	3.3	Wilsonville pilot plant	84
		KY No. 9 and 14	3.85	Ft. Lewis pilot plant*	83
	SRC-II	Powhattan No. 5	0.7814	Ft. Lewis pilot plant (UOP Sample No. 3777-1)	85
	EDS	IL No. 6 (Monterey Mine)	1.3700	One tpd pilot plant; once-through mode (UOP Sample No. 3531-7)	87
		IL No. 6	1.92	One tpd pilot plant; once-through mode (SWRI Sample No. G-C2)	90
		IL No. 6	2.25	One tpd pilot plant, from "typical" run (Run A-7)	99
		IL No. 6 (Monterey Mine)	2.04±0.28	One tpd pilot plant; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	2.25±0.45	One tpd pilot plant; operating conditions: 840°F reactor temperature, 40 minutes residence time, average of ten yield periods	99
		IL No. 6 (Monterey Mine)	0.80±0.20	75 lb per day development unit; average of six operating conditions (800-880°F reactor temperature; 25-100 minutes residence time)	99

(Continued)

Table 247 (Continued)

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Coal raw naphtha	EDS	IL No. 6 (Monterey Mine)	0.85±0.37	75 lb per day development unit; operating conditions: 840°F reactor temperature, 40 minutes residence time, average of 21 yield periods	99
		Wyodak	1.84	One tpd pilot plant, once through mode (SWRI Sample No. G-C3)	90
		Wyodak	2.67	One tpd pilot plant, from "typical" run (Run A-7)	99
		Wyodak	2.73±0.59	One tpd pilot plant; average of six opeating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	2.67±0.44	One tpd pilot plant; operating conditions: 840°F reactor temperature, 60 minutes residence time; average of seven yield periods	99
		Wyodak	0.65±0.48	75 lb per day development unit; average of eight operating conditions (800-880°F reactor temperature; 25-100 minutes residence time)	99
		Wyodak	0.47±0.19	75 lb per day development unit; operating conditions: 880°F reactor temperature, 25 minutes residence time; average of 6 yield periods	99
		NA	2.37	One tpd pilot plant (DuPont "Notebook" Sample No. 16928)	91
	H-Coal	IL No. 6	0.5944	PDU, syncrude mode; rerun naphtha (UOP Sample No. 3531-1-2)	92
		IL No. 6	3.0	PDU, syncrude mode	109
		Wyodak	1.2	PDU, syncrude mode	109
		W. KY No. 11	1.3	PDU, syncrude mode	109

(Continued)

Table 247 (Continued)

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Hydrotreated coal naphtha	SRC-I	KY No. 9	<0.05	Wilsonville pilot plant (APCI Sample No. 1934CB)	82
	SRC-II	Powhattan No. 5	0.0359	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3777-1 (UOP Sample No. 3777-2, UOP Research Plant 505, Run 874)	85
	EDS	IL No. 6 (Monterey Mine)	0.0098	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-7, moderate severity hydrotreatment (UOP Sample No. 3531-12, UOP Research Plant 629, Run 218)	87
	H-Coal	IL No. 6	0.0034	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-1-2, moderate severity hydrotreatment (UOP Sample No. 3531-4, UOP Research Plant 629, Run 215). Operating conditions: LHSV/LHSV, 0.125; P-P (base), 450 psig	92
Coal-derived gasoline	SRC-II	Powhattan No. 5	0.0160 (Period 1)[†] 0.0183 (Period 2) 0.0299 (Period 3) 0.0336 (Period 4) 0.0311 (Period 5) 0.0251 (Period 6)	Bench-scale continuous platforming of hydrotreated coal naphtha Sample No. 3777-2 (UOP Research Plant 636, Run 335)	85

(Continued)

Table 247 (Concluded)

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Coal-derived gasoline	EDS	IL No. 6 (Monterey Mine)	NA (Period 1)[†] 0.0100 (Period 2) 0.0068 (Period 3) 0.0074 (Period 4) 0.0057 (Period 5) 0.0098 (Period 6) 0.0061 (Period 7) 0.0100 (Period 8) NA (Period 9) NA (Period 10)	Bench-scale continuous platforming of moderate hydrotreated coal naphtha Sample No. 3531-12 (UOP Research Plant 508, Run 1456)	87

Explanatory Notes

*See General Comments section, Note 2, for summary of operating conditions used.

[†] Each period refers to a run time having a characteristic set of operating conditions.

Table 248. Sulfur Content

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	0.82	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	0.82	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	0.75	Wilsonville pilot plant, SRC unit sample washed with caustic prior to analysis, (Run No. 220, APCI Sample No. 1933CB)	82
		KY No. 9	0.22	Wilsonville pilot plant, Alcoa coker unit (APCI Sample No. 1899CB)	82
		NA	0.57	Wilsonville pilot plant	84
		KY No. 9 and 14	0.44	Ft. Lewis pilot plant*	83
	SRC-II	Powhattan No. 5	0.4400	Ft. Lewis pilot plant (UOP Sample No. 3777-1)	85
	EDS	IL No. 6 (Monterey Mine)	0.9978	One tpd pilot plant; once-through mode (UOP Sample No. 3531-7)	87
		IL No. 6	0.61	One tpd pilot plant; once-through mode (SWRI Sample No. G-C2)	90
		IL No. 6	0.58	One tpd pilot plant, from "typical" run (Run A-7)	99
		IL No. 6 (Monterey Mine)	0.73±0.14	One tpd pilot plant; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	0.58±0.09	One tpd pilot plant; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6 (Monterey Mine)	0.01±0.01	75 lb per day development unit; average of six operating conditions (800-880°F reactor temperature; 25-100 minutes residence time)	99

(Continued)

Table 248 (Continued)

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Coal raw naphtha	EDS	IL No. 6 (Monterey Mine)	0.01±0.00	75 lb per day development unit; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of 21 yield periods	99
		Wyodak	0.21	One tpd pilot plant, once-through mode (SWRI Sample No. G-C3)	90
		Wyodak	0.05	One tpd pilot plant, from "typical" run (Run A-7)	99
		Wyodak	0.08±0.02	One tpd pilot plant; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	0.05±0.01	One tpd pilot plant; operating conditions: 840°F reactor temperature, 60 minutes residence time; average of seven yield periods	99
		Wyodak	0.00±0.00	75 lb per day development unit; average of eight operating conditions (800-880°F reactor temperature; 25-100 minutes residence time)	99
		Wyodak	0.00±0.00	75 lb per day development unit; operating conditions: 880°F reactor temperature, 25 minutes residence time, average of 6 yield periods	99
		NA	0.60	One tpd pilot plant (DuPont "Notebook" Sample No. 16928)	91
	H-Coal	IL No. 6	0.1289	PDU, syncrude mode; rerun naphtha (UOP Sample No. 3531-1-2)	92
		IL No. 6 (Burning Star Mine)	0.1800	PDU (Ashland oil sample)	96
		IL No. 6 (Burning Star Mine)	0.13	Derived from PDU atmospheric still overhead and vacuum still overhead streams, fuel oil mode (analyzed by BETC)†	97

(Continued)

Table 248 (Continued)

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Coal raw naphtha	H-Coal	IL No. 6 (Monterey Mine)	0.06	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)	97
		Wyodak	0.1	PDU, syncrude mode	109
		W. KY No. 11	0.2	PDU, syncrude mode	109
		IL No. 6	0.2	PDU, syncrude mode	109
Hydrotreated coal naphtha	SCR-II	Powhattan No. 5	0.000022	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3777-1 (UOP Sample No. 3777-2, UOP Research Plant 505, Run 874)	85
	EDS	IL No. 6 (Monterey Mine)	0.00001	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-7, moderate severity hydrotreatment (UOP Sample No. 3531-12, UOP Research Plant 629, Run 218)	87
	H-Coal	IL No. 6	0.00039	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-1-2 moderate severity hydrotreatment (UOP Sample No. 3531-4, UOP Research Plant 629, Run 215). Operating conditions: LHSV/LHSV, 0.125; P-P (base), 450 psig	92

(Continued)

Table 248 (Concluded)

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Coal-derived gasoline	SRC-II	Powhattan No. 5	0.00001 (Period 1)[‡]	Bench-scale continuous platforming of hydrotreated coal naphtha Sample No. 3777-2 (UOP Research Plant 636, Run 335)[§]	85
			0.00001 (Period 2)		
			0.00001 (Period 3)		
			0.00001 (Period 4)		
			0.00001 (Period 5)		
			0.00001 (Period 6)		
	EDS	IL No. 6 (Monterey Mine)	0.00001 (Period 1)[‡]	Bench-scale continuous platforming of moderate hydrotreated coal naphtha Sample No. 3531-12 (UOP Research Plant 508, Run 1456)[#]	87
			0.00001 (Period 2)		
			0.00001 (Period 3)		
			0.00001 (Period 4)		
			0.00001 (Period 5)		
			0.00001 (Period 6)		
			0.00001 (Period 7)		
			0.00001 (Period 8)		
			0.00001 (Period 9)		
			0.00001 (Period 10)		

Explanatory Notes

[*] See General Comments section, Note 2, for summary of operating conditions used.

[†] See General Comments section, Note 3, for summary of operating conditions used.

[‡] Each period refers to a run time having a characteristic set of operating conditions.

[§] See General Comments section, Note 4, for summary of operating conditions used.

[#] See General Comments section, Note 5, for summary of operating conditions used.

Table 249. Nitrogen Content

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	0.35	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	0.29	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	0.33	Wilsonville pilot plant, SRC unit sample washed with caustic prior to analysis, (Run No. 220, APCI Sample No. 1933CB)	82
		KY No. 9	0.35	Wilsonville pilot plant, Alcoa coker unit (APCI Sample No. 1899CB)	82
		NA	0.29	Wilsonville pilot plant	84
		KY No. 9 and 14	0.36	Ft. Lewis pilot plant*	83
	SRC-II	Powhattan No. 5	0.5140	Ft. Lewis pilot plant (UOP Sample No. 3777-1)	85
	EDS	IL No. 6 (Monterey Mine)	0.2097	One tpd pilot plant; once-through mode (UOP Sample No. 3531-7)	87
		IL No. 6	0.223	One tpd pilot plant; once-through mode (SWRI Sample No. G-C2)	90
		IL No. 6	0.17	One tpd pilot plant, from "typical" run (Run A-7)	99
		IL No. 6 (Monterey Mine)	0.14±0.03	One tpd pilot plant; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	0.17±0.05	One tpd pilot plant; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6 (Monterey Mine)	0.07±0.02	75 lb per day development unit; average of six operating conditions (800-880°F reactor temperature; 25-100 minutes residence time)	99

(Continued)

Table 249 (Continued)

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Coal raw naphtha	EDS	IL No. 6 (Monterey Mine)	0.03±0.01	75 lb per day development unit; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of 21 yield periods	99
		Wyodak	0.207	One tpd pilot plant, once-through mode (SWRI Sample No. G-C3)	90
		Wyodak	0.16	One tpd pilot plant, from "typical" run (Run A-7)	99
		Wyodak	0.17±0.02	One tpd pilot plant; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	0.16±0.02	One tpd pilot plant; operating conditions: 840°F reactor temperature, 60 minutes residence time; average of seven yield periods	99
		Wyodak	0.07±0.03	75 lb per day development unit; average of eight operating conditions (800-880°F reactor temperature; 25-100 minutes residence time)	99
		Wyodak	0.08±0.01	75 lb per day development unit; operating conditions: 880°F reactor temperature, 25 minutes residence time; average of 6 yield periods	99
		NA	0.46	One tpd pilot plant, (DuPont "Notebook" Sample No. 16928)	91
	H-Coal	IL No. 6	0.1930	PDU, syncrude mode; rerun naphtha (UOP Sample No. 3531-1-2)	92
		IL No. 6 (Burning Star Mine)	0.1370	PDU (Ashland oil sample)	96
		IL No. 6 (Burning Star Mine)	0.420	Derived from PDU atmospheric still overhead and vacuum still overhead streams, fuel oil mode (analyzed by BETC)†	97

(Continued)

Table 249 (Continued)

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Coal raw naphtha	H-Coal	IL No. 6 (Monterey Mine)	0.212	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)†	97
		IL No. 6	3.0	PDU, syncrude mode	109
Hydrotreated coal naphtha	SRC-I	KY No. 9	0.26	Wilsonville pilot plant (APCI Sample No. 1934CB)	82
	SRC-II	Powhattan No. 5	0.00008	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3777-1 (UOP Sample No. 3777-2, UOP Research Plant 505, Run 874)	85
	EDS	IL No. 6 (Monterey Mine)	0.00002	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-7, moderate severity hydrotreatment (UOP Sample No. 3531-12, UOP Research Plant 629, Run 218)	87
	H-Coal	IL No. 6	0.000063	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-1-2, moderate severity hydrotreatment (UOP Sample No. 3531-4, UOP Research Plant 629, Run 215). Operating conditions: LHSV/LHSV, 0.125; P-P (base), 450 psig	92
Coal-derived gasoline	SRC-II	Powhattan No. 5	0.00001 (Period 1)‡ 0.00001 (Period 2) 0.00001 (Period 3) 0.00001 (Period 4) 0.00001 (Period 5) 0.00001 (Period 6)	Bench-scale continuous platforming of hydrotreated coal naphtha Sample No. 3777-2 (UOP Research Plant 636, Run 335)§	85

(Continued)

Table 249 (Concluded)

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Coal-derived gasoline	EDS	IL No. 6 (Monterey Mine)	0.00001 (Period 1)[‡] 0.00001 (Period 2) 0.00001 (Period 3) 0.00001 (Period 4) 0.00001 (Period 5) 0.00001 (Period 6) 0.00001 (Period 7) 0.00001 (Period 8) 0.00001 (Period 9) 0.00001 (Period 10)	Bench-scale continuous platforming of moderately hydrotreated coal naphtha Sample No. 3531-12 (UOP Research Plant 508, Run 1456)[#]	87

Explanatory Notes

[*] See General Comments section, Note 2, for summary of operating conditions used.

[†] See General Comments section, Note 3, for summary of operating conditions used.

[‡] Each period refers to a run time having a characteristic set of operating conditions.

[§] See General Comments section, Note 4, for summary of operating conditions used.

[#] See General Comments section, Note 5, for summary of operating conditions used.

Table 250. Carbon Content

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	83.26	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	83.39	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	85.99	Wilsonville pilot plant, SRC unit sample washed with caustic prior to analysis, (Run No. 220, APCI Sample No. 1933CB)	82
		KY No. 9	84.43	Wilsonville pilot plant, Alcoa coker unit (APCI Sample No. 1899CB)	82
		KY No. 9 and 14	84.3	Ft. Lewis pilot plant*	83
	SRC-II	Powhattan No. 5	85.87	Ft. Lewis pilot plant (UOP Sample No. 3777-1)	85
	EDS	IL No. 6 (Monterey Mine)	86.24	One tpd pilot plant; once-through mode (UOP Sample No. 3531-7)	87
		IL No. 6	85.25	One tpd pilot plant; once-through mode (SWRI Sample No. G-C2)	90
		IL No. 6	84.66	One tpd pilot plant, from "typical" run (Run A-7)	99
		IL No. 6 (Monterey Mine)	84.70±0.10	One tpd pilot plant; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	84.66±0.76	One tpd pilot plant; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6 (Monterey Mine)	85.88±0.46	75 lb per day development unit; average of six operating conditions (800-880°F reactor temperature; 25-100 minutes residence time)	99

(Continued)

Table 250 (Continued)

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Coal raw naphtha	EDS	IL No. 6 (Monterey Mine)	85.93±0.24	75 lb per day development unit; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of 21 yield periods	99
		Wyodak	85.14	One tpd pilot plant, once-through mode (SWRI Sample No. G-C3)	90
		Wyodak	84.70	One tpd pilot plant, from "typical" run (Run A-7)	99
		Wyodak	84.69±0.68	One tpd pilot plant; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	84.70±1.17	One tpd pilot plant; operating conditions: 840°F reactor temperature; 60 minutes residence time; average of seven yield periods	99
		Wyodak	86.41±1.36	75 lb per day development unit; average of eight operating conditions (800-880°F reactor temperature; 25-100 minutes residence time)	99
		Wyodak	86.68±0.14	75 lb per day development unit; operating conditions: 880°F reactor temperature, 25 minutes residence time, average of 6 yield periods	99
		NA	84.20	One tpd pilot plant (DuPont "Notebook" Sample No. 16928)	91
	H-Coal	IL No. 6	85.90	PDU, syncrude mode; rerun naphtha (UOP Sample No. 3531-1-2)	92
		IL No. 6	84.9	PDU, syncrude mode	109

(Continued)

Table 250 (Continued)

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Hydrotreated coal naphtha	SRC-II	Powhattan No. 5	86.00	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3777-1 (UOP Sample No. 3777-2, UOP Research Plant 505, Run 874)	85
	EDS	IL No. 6 (Monterey Mine)	86.18	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-7, moderate severity hydrotreatment (UOP Sample No. 3531-12, UOP Research Plant 629, Run 218)	87
	H-Coal	IL No. 6	86.45	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-1-2, moderate severity hydrotreatment (UOP Sample No. 3531-4, UOP Research Plant 629, Run 215). Operating conditions: LHSV/LHSV, 0.125; P-P (base), 450 psig	92
Coal-derived gasoline	SRC-II	Powhattan No. 5	87.73 (Period 1)† 87.61 (Period 2) 87.31 (Period 3) 87.89 (Period 4) 88.33 (Period 5) 87.26 (Period 6)	Bench-scale continuous platforming of hydrotreated coal naphtha Sample No. 3777-2 (UOP Research Plant 636, Run 335)#	85

(Continued)

Table 250 (Concluded)

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Coal-derived gasoline	EDS	IL No. 6 (Monterey Mine)	89.30 (Period 1)† 89.48 (Period 2) 88.51 (Period 3) 88.18 (Period 4) 88.89 (Period 5) 88.06 (Period 6) 88.35 (Period 7) 88.96 (Period 8) 90.35 (Period 9) 89.73 (Period 10)	Bench-scale continuous platforming of moderately hydrotreated coal naphtha Sample No. 3531-12 (UOP Research Plant 508, Run 1456)§	87
	H-Coal	IL No. 6	88.92 (Period 5)† 88.20 (Period 10) 88.96 (Period 14)	From bench-scale continuous platforming of moderately hydrotreated coal naphtha Sample No. 3531-4 (UOP Research Plant 636, Run No. 220)#	92

Explanatory Notes

*See General Comments section, Note 2, for summary of operating conditions used.

†See General Comments section, Note 4, for summary of operating conditions used.

‡Each period refers to a run time having a characteristic set of operating conditions.

§See General Comments section, Note 5, for summary of operating conditions used.

#See General Comments section, Note 6, for summary of operating conditions used.

Table 251. Hydrogen Content

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	11.85	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	11.93	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	13.28	Wilsonville pilot plant, SRC unit sample washed with caustic prior to analysis, (Run No. 220, APCI Sample No. 1933CB)	82
		KY No. 9	10.28	Wilsonville pilot plant, Alcoa coker unit (APCI Sample No. 1899CB)	82
		NA	12.18	Wilsonvile pilot plant	84
		KY No. 9 and 14	11.6	Ft. Lewis pilot plant*	83
	SRC-II	Powhattan No. 5	12.91	Ft. Lewis pilot plant (UOP Sample No. 3777-1)	85
	EDS	IL No. 6 (Monterey Mine)	11.80	One tpd pilot plant; once-through mode (UOP Sample No. 3531-7)	87
		IL No. 6	12.45	One tpd pilot plant; once-through mode (SWRI Sample No. G-C2)	90
		IL No. 6	12.34	One tpd pilot plant, from "typical" run (Run A-7)	99
		IL No. 6 (Monterey Mine)	12.39±0.26	One tpd pilot plant; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	12.34±0.54	One tpd pilot plant; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of ten yield periods	99
		IL No. 6 (Monterey Mine)	13.24±0.86	75 lb per day development unit; average of six operating conditions (800-880°F reactor temperature; 25-100 minutes residence time)	99

(Continued)

Table 251 (Continued)

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Coal raw naphtha	EDS	IL No. 6 (Monterey Mine)	13.18±0.13	75 lb per day development unit; operating conditions: 840°F reactor temperature, 40 minutes residence time; average of 21 yield periods	99
		Wyodak	12.56	One tpd pilot plant, once-through mode (SWRI Sample No. G-C3)	90
		Wyodak	12.42	One tpd pilot plant, from "typical" run (Run A-7)	99
		Wyodak	12.33±0.26	One tpd pilot plant; average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	12.42±0.88	One tpd pilot plant; operating conditions: 840°F reactor temperature, 60 minutes residence time; average of seven yield periods	99
		Wyodak	12.87±0.14	75 lb per day development unit; average of eight operating conditions (800-880°F reactor temperature; 25-100 minutes residence time)	99
		Wyodak	12.77±0.10	75 lb per day development unit; operating conditions: 880°F reactor temperature, 25 minutes residence time; average of 6 yield periods	99
		NA	12.04	One tpd pilot plant (DuPont "Notebook" Sample No. 16928)	91
	H-Coal	IL No. 6	12.80	PDU, syncrude mode; rerun naphtha (UOP Sample No. 3531-1-2)	92
		IL No. 6	11.60	PDU, syncrude mode	109

(Continued)

Table 251 (Continued)

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Hydrotreated coal naphtha	SRC-II	Powhattan No. 5	13.66	Bench scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3777-1 (UOP Sample No. 3777-2, UOP Research Plant 505, Run 874)	85
	EDS	IL No. 6 (Monterey Mine)	13.13	Bench scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-7, moderate severity hydrotreatment (UOP Sample No. 3531-12, UOP Research Plant 629, Run 218)	87
	H-Coal	IL No. 6	13.59	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-1-2, moderate severity hydrotreatment (UOP Sample No. 3531-4, UOP Research Plant 629, Run 215). Operating conditions: LHSV/LHSV, 0.125; P-P (base), 450 psig	92
Coal-derived gasoline	SRC-II	Powhattan No. 5	11.36 (Period 1)† 10.91 (Period 2) 10.55 (Period 3) 11.35 (Period 4) 10.42 (Period 5) 10.75 (Period 6)	Bench scale continuous platforming of hydrotreated coal naphtha Sample No. 3777-2 (UOP Research Plant 636, Run 335)‡	85

(Continued)

Table 251 (Concluded)

Material	Process	Coal Type	Value (wt. %)	Sample Description/Source	Reference
Coal-derived gasoline	EDS	IL No. 6 (Monterey Mine)	10.40 (Period 1)[†] 10.74 (Period 2) 11.23 (Period 3) 11.45 (Period 4) 11.43 (Period 5) 11.59 (Period 6) 11.60 (Period 7) 10.51 (Period 8) 10.18 (Period 9) 9.94 (Period 10)	Bench-scale continuous platforming of moderately hydrotreated coal naphtha Sample No. 3531-12 (UOP Research Plant 508, Run 1456)[§]	87
	H-Coal	IL No. 6	10.74 (Period 5)[†] 11.76 (Period 10) 10.11 (Period 14)	From bench-scale continuous platforming of moderately hydrotreated coal naphtha Sample No. 3531-4 (UOP Research Plant 636, Run No. 220)[#]	92

Explanatory Notes

[*] See General Comments section, Note 2, for summary of operating conditions used.

[†] See General Comments section, Note 4, for summary of operating conditions used.

[‡] Each period refers to a run time having a characteristic set of operating conditions.

[§] See General Comments section, Note 5, for summary of operating conditions used.

[#] See General Comments section, Note 6, for summary of operating conditions used.

Table 252A. Trace Elements Content (Qualitative Data)

Material	Process	Coal Type	Trace Metals Present	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	Major Si Minor Na, Fe, K, Ca, Ti, Mg Trace Ni, Cr, Ag, Cu, B, Mn, Pd, Sn	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	Major Si Minor Ca, Zn, Fe, K, Al Trace Ti, Cr, Mn, Ni, Cu, Pb, Br, Zr	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
	EDS	IL No. 6	Fe (XRF)	One tpd pilot plant, once-through mode (SWRI Sample No. G-C2)	90
		Wyodak	None (XRF)	One tpd pilot plant, once-through mode (SWRI Sample No. G-C3)	90

Table 252B. Trace Elements Content (Quantitative Data) (ppmw)

Material	Process	Coal Type	Ti	V	Ca	Al	Cl	Mn	As	Sb	Se	Hg	Br	Ni	Co	Cr	Fe	Na
Coal raw naphtha	SRC-I	NA	NA	NA	NA	NA	NA	NA	0.105± 0.002	0.006± 0.001	<0.009	<0.01	0.25± 0.004	NA	0.0044± 0.0006	0.54± 0.02	58±2	0.51± 0.01
		NA	<1.3	<0.01	<10	0.92	6.19	<0.001	0.010	<1	0.023	7.43*	0.018	<0.14	0.010	0.012	0.86	0.78
		NA	<1.0	<0.1	0.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.8	0.60
	EDS	IL No. 6	NA	NA	0.670	NA	NA	0.029	NA	NA	NA	NA	NA	0.049	NA	NA	4	0.720
	SRC-II	NA	<0.012	<0.02	0.18	<0.4	NA	<0.006	0.006†	0.004†	0.00006	NA	NA	<0.05	<0.04	<0.06	0.44	0.84
	H-Coal	IL No. 6	ND(2)	0.1	0.08	2.3	NA	NA	0.005	NA	NA	ND (0.02)	NA	0.1	ND (0.01)	NA	0.4	0.3
		IL No. 6	NA	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2	NA	NA	0.5	NA
		Wyodak	ND(2)	0.1	0.12	2.9	NA	NA	0.023	NA	NA	0.013	NA	0.1	ND (0.02)	NA	0.9	0.32
		W. KY No. 11	0.01	<0.02	0.21	<0.3	NA	NA	0.002	NA	NA	ND (0.004)	NA	<0.5	ND (0.04)	NA	0.7	3.4
Hydro-treated coal naphtha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Coal-derived gasoline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

(Continued)

Table 252B (Continued)

Material	Process	Coal Type	Rb	Cs	K	Sc	Tb	Lu	Sm	Ce	La	Sr	Ba	Th	Hf	Ta	Ga	Zr
Coal raw naphtha	SRC-I	NA	<0.06	<0.002	NA	0.0044 ± 0.0001	<0.0002	<0.0001	0.0023 ± 0.0001	NA	0.0125 ± 0.008	NA	<2	<0.001	<0.004	NA	NA	NA
		NA	<0.02	2.89*	<0.1	0.063*	<0.6*	1.40*	<0.046*	<7*	<0.7	<0.3	<0.3	<0.7*	<0.7*	<0.9*	6.15*	<0.2
		NA	NA	NA	0.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	EDS	IL No. 6	NA	NA	0.320	NA	NA	NA	NA	NA	NA	NA	0.013	NA	NA	NA	NA	NA
	SRC-II	NA	NA	NA	<0.02	NA	NA	NA	NA	NA	NA	<0.002	<0.002	NA	NA	NA	NA	NA
	H-Coal	IL No. 6	NA	NA	0.07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		IL No. 6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Wyodak	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		W. KY No. 11	NA	NA	1.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hydro-treated coal naphtha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Coal-derived gasoline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

(Continued)

Table 252B (Concluded)

Material	Process	Coal Type	Cu	Zn	Mg	Pb	Si	Mo	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	NA	NA	0.86 ± 0.04	NA	NA	NA	NA	Ft. Lewis pilot plant[§]	146
		NA	0.037	0.02	NA	NA	NA	NA	Ft. Lewis pilot plant	106
		NA	NA	NA	NA	NA	NA	NA	Wilsonville pilot plant[†]	84
	EDS	IL No. 6	NA	NA	0.160	NA	NA	NA	One tpd pilot plant once-through mode	107
	SRC-II	NA	0.18	0.35	0.08	<0.16	2.3	<0.08	Ft. Lewis pilot plant	125
	H-Coal	IL No. 6	NA	NA	0.01	0.2	34	ND (0.01)	PDU, syncrude mode	109
		IL No. 6	NA	NA	NA	NA	NA	NA	PDU (Ashland oil sample)	96
		Wyodak	NA	NA	0.03	0.1	27	ND (0.02)	PDU, syncrude mode	109
		W. KY No. 11	NA	NA	0.09	<0.15	32	<0.02	PDU, syncrude mode	109
Hydro-treated coal naphtha	NA	---			--				--	--
Coal-derived gasoline	NA	--			--				--	--

Explanatory Notes

*Values in ppb

[†] <0.1 ppmw of phosphorous also reported for this sample.

[‡] Determined by flameless AAS. All other elements determined by ICP.

[§] Determined by neutron activation analysis.

Table 253. Saturates, Olefins and Aromatics Contents

Material	Process	Coal Type	Value (vol. %)	Sample Description/Source	Reference
A. Saturates					
Coal raw naphtha	SRC-I	KY No. 9	39.90[*] (wt. %) 59.0[†]	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	36.39[*] (wt. %)	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	79.90[*] (wt. %)	Wilsonville pilot plant, sample washed with caustic prior to analysis, (Run No. 220, APCI Sample No. 1933CB)	82
	SRC-II	Powhattan No. 5	68.6[‡]	Ft. Lewis pilot plant (UOP Sample No. 3777-1)	85
	EDS	IL No. 6 (Monterey Mine)	46.2[‡,§]	One tpd pilot plant; once-through mode (UOP Sample No. 3531-7)	87
	H-Coal	IL No. 6	70.1[#] 66.2[**]	PDU, syncrude mode; rerun naphtha (UOP Sample No. 3531-1-2)	92
		IL No. 6 (Burning Star Mine)	33.9 (wt. %)	Derived from PDU atmospheric still overhead and vacuum still overhead streams, fuel oil mode (analyzed by BETC)[††]	97
		IL No. 6 (Monterey Mine)	42.6 (wt. %)	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)[††]	97

(Continued)

Table 253 (Continued)

Material	Process	Coal Type	Value (vol. %)	Sample Description/Source	Reference
B. Olefins					
Coal raw naphtha	SRC-I	KY No. 9	10.9[†] 1.5[‡‡] (wt. %)	Wilsonville pilot plant (Run No. 220, APCI Sample No. 1896CB)	82
	SRC-II	Powhattan No. 5	8.4[‡]	Ft. Lewis pilot plant (UOP Sample No. 3777-1)	85
	EDS	IL No. 6 (Monterey Mine)	9.9[‡]	One tpd pilot plant; once-through mode (UOP Sample No. 3531-7)	87
		IL No. 6	4.9	One tpd pilot plant; once-through mode (SWRI Sample No. G-C2)	90
		Wyodak	0	One tpd pilot plant; once-through mode (SWRI Sample No. G-C3)	90
	H-Coal	IL No. 6	5.2[#] 5.5[‡]	PDU, syncrude mode; rerun naphtha (UOP Sample No. 3531-1-2)	92
		IL No. 6 (Burning Star Mine)	5.9 (wt. %)	Derived from PDU atmospheric still overhead and vacuum still overhead streams, fuel oil mode (analyzed by BETC)[††]	97
		IL No. 6 (Monterey Mine)	3.6 (wt. %)	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)[††]	97

(Continued)

Table 253 (Continued)

Material	Process	Coal Type	Value (vol. %)	Sample Description/Source	Reference
C. Aromatics					
Coal raw naphtha	SRC-I	KY No. 9	30.1[†] 25.37* (wt. %)	Wilsonville pilot plant (Run No. 220, APCI Sample No. 1896CB)	82
		KY No. 9	6.99* (wt. %)	Wilsonville pilot plant (Run No. 225, APCI Sample No. 1910CB)	82
		KY No. 9	Nil* (wt. %)	Wilsonville pilot plant, sample washed with caustic prior to analysis, (Run No. 220, APCI Sample No. 1933CB)	82
	SRC-II	Powhattan No. 5	23.0[‡,§§]	Ft. Lewis pilot plant (UOP Sample No. 3777-1)	85
	EDS	IL No. 6 (Monterey Mine)	25.3[‡]	One tpd pilot plant; once-through mode (UOP Sample No. 3531-7)	87
		IL No. 6	30.8	One tpd pilot plant; once-through mode (SWRI Sample No. G-C2)	90
		Wyodak	32	One tpd pilot plant: once-through mode (SWRI Sample No. G-C3)	90
	H-Coal	IL No. 6	24.7[#] 18.6[‡]	PDU, syncrude mode; rerun naphtha (UOP Sample No. 3531-1-2)	92
		IL No. 6 (Burning Star Mine)	34.2	Derived from PDU atmospheric still overhead and vacuum still overhead streams, fuel oil mode (analyzed by BETC)[††]	97
		IL No. 6 (Monterey Mine)	31.6	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)[††]	97

(Continued)

Table 253 (Continued)

Material	Process	Coal Type	Value (vol. %)	Sample Description/Source	Reference
A. Saturates					
Hydrotreated coal naphtha	SRC-II	Powhattan No. 5	81.2[#] 78.0[‡]	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3777-1 (UOP Sample No. 3777-2, UOP Research Plant 505, Run 874)	85
	EDS	IL No. 6 (Monterey Mine)	79.9[#] 73.38[‡]	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-7, moderate severity hydrotreatment (UOP Sample No. 3531-12, UOP Research Plant 629, Run 218)	87
	H-Coal	IL No. 6	81.1[#] 82.4[‡]	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-1-2, moderate severity hydrotreatment (UOP Sample No. 3531-4, UOP Research Plant 629, Run 215). Operating conditions: LHSV/LHSV, 0.125; P-P (base), 450 psig	92
B. Olefins					
Hydrotreated coal naphtha	SRC-II	Powhattan No. 5	ND[‡]	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3777-1 (UOP Sample No. 3777-2, UOP Research Plant 505, Run 874)	85
	H-Coal	IL No. 6	0.0[#]	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-1-2, moderate severity hydrotreatment (UOP Sample No. 3531-4, UOP Research Plant 629, Run 215). Operating conditions: LHSV/LHSV, 0.125; P-P (base), 450 psig	92

(Continued)

Table 253 (Concluded)

Material	Process	Coal Type	Value (vol. %)	Sample Description/Source	Reference
C. Aromatics					
Hydrotreated coal naphtha	SRC-II	Powhattan No. 5	18.8[#] 22.0[‡]	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3777-1 (UOP Sample No. 3777-2, UOP Research Plant 505, Run 874)	85
	EDS	IL No. 6 (Monterey Mine)	20.1[#] 21.62[‡]	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-7, moderate severity hydrotreatment (UOP Sample No. 3531-12, UOP Research Plant 629, Run 218)	87
	H-Coal	IL No. 6	18.9[#] 17.6[‡]	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-1-2, moderate severity hydrotreatment (UOP Sample No. 3531-4, UOP Research Plant 629, Run 215). Operating conditions: LHSV/LHSV, 0.125; P-P (base), 450 psig	92
Coal-derived gasoline	NA	--	--	--	--

Explanatory Notes

[*] Determined via APCI adsorption chromatography method.
[†] PONA analysis (after polars removed).
[‡] MS hydrocarbon types, vol. %.
[§] Includes 8.7 vol. % polars.
[#] Flame ionization analysis (FIA).
[**] Includes 4.2 vol. % polars.
[††] See General Comments section, Note 3, for summary of operating conditions used.

[‡‡] Olefins determined by bromination of the sample and reanalysis by GC/MS
[§§] Includes 6.8 vol. % polars.

Table 254. Detailed Hydrocarbon Class/Compound Analysis[*]

Material	Process	Coal Type	Compound/Class	Wt %	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	Toluene	5.7[†]	Wilsonville pilot plant, SRC unit (Run No. 220 APCI Sample No. 1896CB)	82
			Cyclohexane	2.6		
			Methyl-Cyclohexane	2.4		
			Methyl-Cyclopentane	2.2		
			Hexane	2.2		
			2-Methyl-Pentane	2.1		
			Pentane	2.1		
			Heptane	1.8		
			Di-Methyl-Benzene	1.8		
			2,3-Dihydro-Indene	1.8		
			Decane	1.7		
			Octane	1.6		
			1,2,3,4-Tetrahydro-Naphthalene	1.6		
			Nonane	1.5		
			Ethyl-Cyclohexane	1.5		
			Ethyl-Methyl-Benzene	1.4		
			Trimethyl-Benzene	1.4		

(Continued)

Table 254 (Continued)

Material	Process	Coal Type	Compound/Class	Wt %	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	Toluene	$6.6^{\dagger}$	Wilsonville pilot plant, SRC unit (Run No. 225 APCI Sample No. 1910CB)	82
			Cyclohexane	3.0		
			Nonane	2.8		
			Methyl-Cyclopentane	2.7		
			Methyl-Cyclohexane	2.6		
			Hexane	2.6		
			Pentane	2.4		
			2-Methyl-Pentane	2.2		
			2,3-Dihydro-Indene	2.0		
			Heptane	2.0		
			Methyl-Benzene	1.9		
			1,2,3,4-Tetrahydro-Naphthalene	NA		
			Octane	1.7		
			Ethyl-Methyl-Benzene	1.5		
			Ethyl-Methyl-Cyclopentane	1.5		
			Dimethyl-Benzene	1.4		
			Methyl-2,3-Dihydro-Indene	1.3		

(Continued)

Table 254 (Continued)

Material	Process	Coal Type	Compound/Class	Wt %	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	Dimethyl-Benzene	16†	Wilsonville pilot plant, Alcoa coker unit (APCI Sample No. 1899CB)	82
			Toluene	5.8†		
			Ethyl-Benzene	5.6		
			Dimethyl-Benzene	5.0		
			Nonane	2.1		
			2,3-Dihydro-Indene	2.0		
			Naphthalene	1.8		
			Ethyl-Methyl-Benzene	1.7		
			Trimethyl-Benzene	1.6		
			4/5-Methyl-2,3-Dihydro-Indene	1.6		
			Dodecane	1.5		
			Undecane	1.3		
			Methyl-Benzene	1.9		
			1,2,3,4-Tetrahydro-Naphthalene	1.3		
			Decane	1.3		
			Methyl-2,3-dihydro-Indene	1.2		
			Trimethyl-Benzene	0.99		

(Continued)

Table 254 (Continued)

Material	Process	Coal Type	Compound/Class	Wt %	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	NA	n-Octane	1.60	Ft. Lewis pilot plant†	146
			n-Nonane	0.87		
			n-Decane	0.98		
			n-Undecane	0.39		
			n-Dodecane	0.14		
			n-Tridecane	0.047		
			n-Tetradecane	0.017		
			n-Pentadecane	0.006		
			n-Hexadecane	0.001		
			n-Heptadecane	0.001		
			o-Ethylbenzene	0.98		
			C_3-Benzene	0.39		
			Indan	0.43		
			Methylindan	0.051		
			Methylindan	0.018		
			Methylindan	0.024		
			Dimethylindan	<.0005		
			Tetralin	0.033		
			Dimethyltetralin	<0.0005		
			6-Methyltetralin	0.0110		
			Naphthalene	0.163		

(Continued)

Table 254 (Continued)

Material	Process	Coal Type	Compound/Class	Wt %	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	NA	2-Methylnaphthalene	0.069	Ft. Lewis pilot plant[†]	146
			1-Methylnaphthalene	0.011		
			Dimethylnaphthalene	0.008		
			Dimethylnaphthalene	0.007		
			Dimethylnaphthalene	0.010		
			Biphenyl	0.0080		
			Acenaphthylene	0.0002		
			Dimethylbiphenyl	0.0015		
			Dimethylbiphenyl	0.0021		
			Dibenzofuran	0.0008		
			Xanthene	0.0010		
			Dibenzothiophene	0.0003		
			Dimethyldibenzothiophene	0.0005		
			Fluorene	0.0015		
			9-Methylfluorene	0.0015		
			1-Methylfluorene	0.001		
			Anthracene/phenanthrene	0.0025		
			Methylphenanthrene	0.0006		
			1-Methylphenanthrene	0.0006		
			C2-Anthracene	0.0006		
			Fluoranthene	0.0015		
			Dihydropyrene	0.0006		
			Pyrene	0.002		

(Continued)

Table 254 (Continued)

Material	Process	Coal Type	Series	Compound/Class	Wt %	Vol. %	Sample Description/Source	Reference
Coal raw naphtha	SRC-II	Powhattan No. 5	C_nH_{2n+2}	Paraffins	27.8*	31.5*	Ft. Lewis pilot plant (UOP Sample No. 3777-1)	85
				Naphthenes				
			C_nH_{2n}	Monocycloparaffins	28.4	28.9		
				Cyclopentanes	ND	ND		
				Cyclohexanes	ND	ND		
			C_nH_{2n-2}	Bi,Dicycloparaffins	7.1	7.2		
			C_nH_{2n-4}	Tricycloparaffins	1.0	1.0		
				Total Naphthenes	36.5	37.1		
				Aromatics				
			C_nH_{2n-6}	Alkylbenzenes	17.4	15.6		
			C_nH_{2n-8}	Indanes/Tetralins	0.7	0.6		
			C_nH_{2n-10}	Dinaphthenebenzenes	<0.1	Trace		
			C_nH_{2n-12}	Naphthalenes	<0.05	Trace		
				Total Aromatics	18.25	16.2		
				Olefins†				
				Monoolefins	1.9	2.1		
				Diolefins and/or monocycloolefins	5.1	5.0		
				Triolefins and/or dicycloolefins	1.4	1.3		
				Total Olefins	8.4	7.4		

(Continued)

Table 254 (Continued)

Material	Process	Coal Type	Series	Compound/Class	Wt %	Vol. %	Sample Description/Source	Reference
Coal raw naphtha	EDS	IL No. 6 (Monterey Mine)	C_nH_{2n+2}	Paraffins	11.3	13.2	One tpd pilot plant; once-through mode (UOP Sample No. 3531-7)	87
				Naphthenes				
			C_nH_{2n}	Monocycloparaffins	ND	ND		
				Cyclopentanes	9.8	10.4		
				Cyclohexanes	14.1	15.0		
			C_nH_{2n-2}	Bi,Dicycloparaffins	10.9	10.5		
			C_nH_{2n-4}	Tricycloparaffins	7.4	7.0		
				Total Naphthenes	42.2	42.9		
				Aromatics				
			C_nH_{2n-6}	Alkylbenzenes	17.5	17.0		
			C_nH_{2n-8}	Indanes/Tetralins	8.7	7.9		
			C_nH_{2n-10}	Dinaphthenebenzenes	0.5	0.4		
			C_nH_{2n-12}	Naphthalenes	Trace	Trace		
				Total Aromatics	26.7	25.3		
				Olefins‡				
				Monoolefins	2.3	2.6		
				Diolefins and/or monocycloolefins	5.4	5.8		
				Triolefins and/or dicycloolefins	1.4	1.5		
				Total Olefins	9.1	9.9		

(Continued)

Table 254 (Continued)

Material	Process	Coal Type	Series	Compound/Class	Wt %	Sample Description/Source	Reference
Coal raw naphtha	EDS	IL No. 6 (Monterey Mine)	Paraffins		13.95	One tpd pilot plant; operating conditions: 840°F reactor temperature, 40 min-residence time, 1500 psi reactor pressure; average of yield period Nos. 256-265	99
			Naphthenes		51.47		
			Hydrindane		0.96		
			Decalin/Methyl-Hydrindane		2.19		
			Benzene		0.37		
			Toluene		2.03		
			C_8-Aromatics		4.57		
			C_9-Aromatics		3.66		
			C_{10}-Aromatics		2.65		
			C_{11}-Aromatics		0.76		
			Indane		1.99		
			Tetralin/Methyl-Indane		3.18		
			Methyl-Tetralin/C_1 Indane		0.31		
			Indane		0.13		
			Methyl-Indenes		ND		
			Naphthalene		ND		
			Methyl-Napthalene		ND		

(Continued)

Table 254 (Continued)

Material	Process	Coal Type	Series	Compound/Class	Wt %	Sample Description/Source	Reference
Coal raw naphtha	EDS	Wyodak	Paraffins		19.94	One tpd pilot plant; operating conditions: 840°F reactor temperature, 60 min-residence time, 1500 psi reactor pressure; average of yield period Nos. 267-270	99
			Naphthenes		47.02		
			Hydrindane		0.28		
			Decalin/Methyl Hydrindane		4.96		
			Benzene		0.44		
			Toluene		3.34		
			C_8-Aromatics		5.21		
			C_9-Aromatics		3.80		
			C_{10}-Aromatics		2.32		
			C_{11}-Aromatics		0.16		
			Indane		2.37		
			Tetralin/Methyl Indane		2.47		
			Methyl-Tetralin/C_{11} Indane		0.16		
			Indene		0.04		
			Methyl-Indenes		ND		
			Naphthalene		ND		
			Methyl-Napthalene		ND		

(Continued)

Table 254 (Continued)

Material	Process	Coal Type	Compound/Class	ppm	Sample Description/Source	Reference
Coal raw naphtha	EDS	IL No. 6	Butane	160	One tpd pilot plant, once-through mode	107
			Pentane	3,100		
			Cyclopentane	3,200		
			Methyl Cyclopentane	33,000		
			Cyclohexane	43,000		
			Methyl Cyclohexane	36,000		
			C2 Cyclohexane	2,200		
			C6 Alkane	15,000		
			C7 Alkane	14,000		
			C8 Alkane	57,000		
			C10 Alkane	5,800		
			C6 Alkene	12,000		
			C7 Alkene	63,000		
			C8 Alkene	240,000		
			C6 Diene	49,000		
			C7 Diene	40,000		
			C8 Diene	93,000		
			C9 Alkene	87,000		
			C9 Diene	52,000		
			C10 Alkene	29,000		
			C10 Diene	27,000		
			C11 Alkene	3,500		
			Benzene	6,000		
			Toluene	37,000		
			C2 Benzene	66,000		
			C3 Benzene	6,400		
			C4 Benzene	12,000		

(Continued)

Table 254 (Continued)

Material	Process	Coal Type	Compound/Class	WT %	Vol. %	Sample Description/Source	Reference
Coal raw naphtha	H-Coal	IL No. 6	Paraffins		16.2	PDU, syncrude mode; rerun naphtha (UOP Sample No. 3531-1-2)	92
			Naphthenes				
			Monocycloparaffins		48.1		
			Bi, Dicycloparaffins		7.2		
			Tricycloparaffins		0.2		
			Total Naphthenes		55.5		
			Aromatics				
			Alkylbenzenes		12.7		
			Indanes/Tetralins		5.8		
			Naphthalenes		0.1		
			Total Aromatics		18.6		
			Olefins[‡]				
			Monoolefins		1.3		
			Diolefins or Monocycloolefins		3.7		
			Triolefins or Dicyclo-monoolefins		0.5		
			Total Olefins		5.5		
		IL No. 6 (Burning Star Mine)	Paraffins	9.5		Derived from PDU atmospheric still overhead and vacuum still overhead streams, fuel oil mode (analyzed by BETC)[§]	97
			Monocycloparaffins	15.6			
			Dicycloparaffins	13.8			
			Alkylbenzenes	14.4			
			Monocyclic benzenes (indanes and tetralins)	11.8			
			Naphthalenes	3.0			
			Olefins	5.9			
			Total	74.0			

(Continued)

Table 254 (Continued)

Material	Process	Coal Type	Compound/Class	Wt %	Vol. %	Sample Description/Source	Reference
Coal raw naphtha	H-Coal	IL No. 6 (Monterey Mine)	Paraffins	10.7		Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)§	97
			Monocycloparaffins	21.7			
			Dicycloparaffins	13.2			
			Alkylbenzenes	14.3			
			Monocyclic benzenes (indanes and tetralins)	11.0			
			Naphthalenes	3.3			
			Olefins	3.6			
			Total	77.8			
Hydro-treated coal naphtha	SRC-II	Powhattan No.5	Paraffins		25.20	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3777-1 (UOP Sample No. 3777-2, UOP Research Plant 505, Run 874)	85
			Naphthenes				
			Monocycloparaffins		47.28		
			Bi,Dicycloparaffins		5.57		
			Tricycloparaffins		0.0		
			Total Naphthenes		52.85		
			Aromatics				
			Alkylbenzenes		21.53		
			Indanes, Tetralins		0.42		
			Naphthalenes		0.0		
			Total Aromatics		21.95		
			Total		100.00		

(Continued)

Table 254 (Continued)

Material	Process	Coal Type	Compound/Class	Vol. %	Sample Description/Source	Reference
Hydro-treated coal naphtha	EDS	IL No. 6 (Monterey Mine)	Paraffins	12.90	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-7 (UOP Sample No. 3531-12, UOP Research Plant 629, Run 218)	87
			Naphthenes			
			Monocycloparaffins	50.15		
			Bi,Dicycloparaffins	15.33		
			Tricycloparaffins	0.0		
			Total Naphthenes	65.48		
			Aromatics			
			Alkylbenzenes	17.82		
			Indanes, Tetralins	3.80		
			Naphthalenes	0.0		
			Total Aromatics	21.61		
			Total	100.00		
	H-Coal	IL No. 6	Paraffins	15.96	Bench-scale continuous hydrotreating of UOP coal raw naphtha Sample No. 3531-1-2, moderate severity hydrotreatment (UOP Sample No. 3531-4, UOP Research Plant 629, Run 215). Operating conditions: LHSV/LHSV, 0.125; P-P (base), 450 psig	92
			Naphthenes			
			Monocycloparaffins	55.02		
			Bi, Dicycloparaffins	9.49		
			Tricycloparaffins	0.09		
			Total Naphthenes	64.60		
			Aromatics			
			Alkylbenzenes	16.54		
			Indanes, Tetralins	2.83		
			Naphthalenes	0.07		
			Total Aromatics	19.44		
			Total	100.00		

(Continued)

Table 254 (Continued)

Material	Process	Coal Type	Compound/Class	Vol. %		Sample Description/Source	Reference
Coal-derived gasoline	EDS	Wyodak	Acenaphthene	0.0990	0.1070	Reformed 370°F (end point) naphtha from one tpd pilot plant, having Research Octane No. (clear) values of 100.3 and 104.6, respectively	99
			Fluorene	0.1160	0.1510		
			Phenanthrene	0.0920	0.1360		
			Fluoranthene	0.0720	0.1070		
			Benz(a)anthracene	0.0130	0.0170		
			Dimethylbenz(a)anthracene	0.0009	0.0027		
			2-Dimethylbenz(a)anthracene	0.0004	0.0016		
			Coronene	0.0001	0.0004		
			Total	0.3935	0.5230		
		IL No. 6	Acenaphthene	0.0430		Reformed 340°F (end point) naphtha from one tpd pilot plant, having Research Octane No. (clear) value of 105.3	99
			Fluorene	0.1110			
			Phenanthrene	0.0890			
			Fluoranthene	0.0540			
			Benz(a)anthracene	0.0044			
			Dimethylbenz(a)anthracene	0.0005			
			2-Dimethylbenz(a)anthracene	0.0006			
			Coronene	0.0001			
			Total	0.3025			
		Wyodak	Acenaphthene	0.0410		Reformed 325°F (end point) naphtha from one tpd pilot plant, having Research Octane No. (clear) value of 105.2	99
			Fluorene	0.1040			
			Phenanthrene	0.0710			
			Fluoranthene	0.0320			
			Benz(a)anthracene	0.0023			
			Dimethylbenz(a)anthracene	0.0004			
			2-Dimethylbenz(a)anthracene	0.0004			
			Coronene	0.0001			
			Total	0.2510			

(Continued)

Table 254 (Concluded)

Material	Process	Coal Type	Compound/Class	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 9	Sample Description/Source	Reference
Coal-derived gasoline	SRC-II	Powhattan No. 5	Paraffins	26.39	23.89	20.60	25.19	16.21	20.61	NA	Bench-scale continuous platforming of hydro-treated coal naphtha Sample No. 3777-2 (UOP Research Plant 636, Run 335)	85
			Naphthenes									
			Monocycloparaffins	13.60	8.34	7.40	10.77	5.03	6.80			
			Bi,Dicycloparaffins	1.63	0.74	0.28	1.39	0.36	1.20			
			Tricycloparaffins	0.0	0.0	0.0	0.0	0.0	0.0			
			Total Naphthenes	15.23	9.08	7.68	12.16	5.39	8.00			
			Aromatics									
			Alkylbenzenes	56.37	64.93	69.36	60.52	75.80	68.13			
			Indanes, Tetralins	2.01	2.10	2.11	1.97	2.17	2.96			
			Naphthalenes	0.0	0.0	0.25	0.16	0.43	0.27			
			Total Aromatics	58.38	67.03	71.72	62.65	78.4	71.36			
			Total	100.00	100.00	100.00	100.00	100.00	100.00			
	EDS	IL No. 6 (Monterey Mine)	Paraffins	NA	15.37	NA	16.55	NA	15.38	14.98	Bench-scale continuous platforming of hydro-treated coal naphtha Sample No. 3531-12 (UOP Research Plant 508, Run 1456)	87
			Naphthenes									
			Monocycloparaffins		7.82		15.56		24.25	5.26		
			Bi,Dicycloparaffins		1.18		1.02		0.99	0.38		
			Tricycloparaffins		0.0		0.0		0.0	0.0		
			Total Naphthenes		9.00		16.58		25.24	5.64		
			Aromatics									
			Alkylbenzenes		64.20		56.24		48.39	68.54		
			Indanes, Tetralins		9.53		8.88		10.60	7.99		
			Naphthalenes		1.90		1.75		0.39	2.85		
			Total Aromatics		75.63		66.87		59.38	79.38		
			Total		100.00		100.00		100.00	100.00		
					Period 5		Period 10		Period 14			
Coal-derived gasoline	H-Coal	IL No. 6	Paraffins		18.85		17.84		11.71		From bench-scale continuous platforming of moderately hydrotreated coal naphtha Sample No. 3531-4 (UOP Research Plant 636, Run No. 220)	92
			Naphthenes									
			Monocycloparaffins		8.80		14.90		4.63			
			Bi,Dicycloparaffins		0.63		1.45		0.32			
			Tricycloparaffins		0.0		0.00		0.0			
			Total Naphthenes		9.43		16.35		4.95			
			Aromatics									
			Alkylbenzenes		61.99		55.78		74.38			
			Indanes, Tetralins		7.72		8.41		6.33			
			Naphthalenes		2.01		1.62		2.63			
			Total Aromatics		71.72		65.81		83.34			
			Total		100.00		100.00		100.00			

Explanatory Notes

*All values by MS Analyses.

†Values by GC/MS analyses; the compounds listed are the twenty most prevalent compounds present in the sample.

‡The total olefin number was obtained by SiO_2 separation, but the mono-,di,tri-olefin split is estimated since no calibration coefficients are available.

§See General Comments section, Note 3, for summary of operating conditions used.

Table 255. Nitrogen-, Oxygen- and Sulfur-Containing Compounds*

Material	Process	Coal Type	Value Compound Class	Wt. %	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	3&4 Methyl Phenols	7.5†	Wilsonville pilot plant,	82
			Phenol	7.4	SRC unit (Run No. 220,	
			2-Methyl Phenol	4.2	APCI Sample No. 1896CB)	
			Total Phenols	25.54		
		KY No. 9	3&4 Methyl Phenols	6.1†	Wilsonville pilot plant,	82
			Phenol	7.4	SRC unit (Run No. 225,	
			2-Methyl Phenol	5.6	APCI Sample No. 1910CB)	
			Total Phenols	56.65		
		KY No. 9	Total Phenols	17.92	Wilsonville pilot plant, SRC unit, sample washed with caustic prior to analysis (Run No. 220, APCI Sample No. 1933CB)	82
		KY No. 9	3&4 Methyl Phenols	11	Wilsonville pilot plant,	82
			Phenol	5.8	Alcoa coker unit (APCI	
			2-Methyl Phenol	5.0	Sample No. 1899CB)	

(Continued)

Table 255 (Continued)

			Value			
Material	Process	Coal Type	Compound Class	Wt. %	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	KY No. 9	Phenol	5.65	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1896CB) caustic extraction with 20% NaOH (1/1-v/v); GC analysis of extract	82
			o-Cresol	3.19		
			m+p-Cresol	6.22		
			2,6-Xylenol	0.20		
			o-Ethylphenol	0.25		
			2,4+2,5-Xylenol	0.56		
			m+p-Ethylphenol	0.49		
			2,3-Xylenol	0.05		
			3,4-Xylenol	0.04		
			Total	16.65		
		KY No. 9	Phenol	7.75	Wilsonville pilot plant SRC unit (Run No. 225, APCI Sample No. 1910CB); caustic extraction with 20% NaOH (1/1-v/v); GC analysis of extract	82
			o-Cresol	3.74		
			m+p-Cresol	5.51		
			2,6-Xylenol	0.14		
			o-Ethylphenol	0.09		
			2,4+2,5-Xylenol	0.08		
			m+p-Ethylphenol	0.01		
			2,3-Xylenol	0.02		
			3,4-Xylenol	----		
			Total	17.34		
		KY No. 9	Phenol	4.62	Wilsonville pilot plant, Alcoa coker unit (APCI Sample No. 1899CB); caustic extraction with 20% NaOH (1/1-v/v); GC analysis of extract	82
			o-Cresol	3.77		
			m+p-Cresol	10.33		
			2,6-Xylenol	0.44		
			o-Ethylphenol	0.44		
			2,4+2,5-Xylenol	1.10		
			m+p-Ethylphenol	0.29		
			2,3-Xylenol	0.06		
			3,4-Xylenol	0.04		
			Total	21.09		

(Continued)

Table 255 (Continued)

Material	Process	Coal Type	Value Compound Class		Wt. %	Vol. %	Sample Description/Source	Reference
Coal raw naphtha	SRC-II	Powhattan No. 5	$C_nH_{2n-5}N$	Pyridines	3.0	2.3	Ft. Lewis pilot plant (UOP Sample No. 3777-1)	85
			$C_nH_{2n-4}O$	Furans	ND	ND		
			$C_nH_{2n-6}O$	Phenols	4.5	3.2		
			$C_nH_{2n-7}N$	Naphtheno-pyridines	Trace	Trace		
			$C_nH_{2n-4}S$	Thiophenes	1.6	1.3		
				Total	26.7	25.3		
	EDS	IL No. 6 (Monterey Mine)	$C_nH_{2n-4}O$	Furans	Trace	Trace	One tpd pilot plant; once-through mode (UOP Sample No. 3531-7)	87
			$C_nH_{2n-6}O$	Phenols	9.1	7.4		
			$C_nH_{2n-7}N$	Naphtheno-pyridines	0.1	0.1		
			$C_nH_{2n-4}S$	Thiophenes	1.5	1.2		
				Total	10.7	8.7		
		IL N. 6 (Monterey Mine)		Phenol	3.72		One tpd pilot plant; operating conditions: 840°F reactor temperature, 40 minutes residence time, 1500 psi reactor pressure; average of yield period Nos. 256-265	99
				Cresols	7.46			
				Xylenols	0.60			
		Wyodak		Phenol	4.64		One tpd pilot plant; operating conditions: 840°F reactor temperature. 60 minutes residence time	99
				Cresols	2.70			
				Xylenols	0.15			

(Continued)

Table 255 (Continued)

Material	Process	Coal Type	Value Compound Class	Vol. %	Sample Description/Source	Reference
Coal raw naphtha	EDS	IL No. 6	**Ethers**		One tpd pilot plant, once-through mode	107
			Dioxane	4,100		
			Methyl Dioxane	2,400		
			C2 Dioxane	3,000		
			Tetrahydrofuran	45		
			Aldehydes, ketones			
			Methyl-N-Butyl ketone	880		
			Methyl-Iso-Butyl ketone	2,000		
			Phenols			
			O-Cresol	1,300		
			C2 Phenol	5,900		
			C3 Phenol	900		
			Heterocyclic oxygen compounds			
			Methyl Furan	11,000		
			Benzofuran	22,000		
			Methyl benzofuran	14,000		
			C2 benzofuran	800		
			Heterocyclic sulfur compounds			
			Thiophene	350		
			Methyl thiophene	1,700		
			C2 thiophenes	16,000		

(Continued)

Table 255 (Continued)

Material	Process	Coal Type	Value Compound Class	Wt. %	Sample Description/Source	Reference
Coal raw naphtha	H-Coal	IL No. 6	Heterocyclic		PDU, syncrude mode	109
			Methyl Pyridines	1.3		
			C2 Pyridines	5.3		
			C3 Pyridines	6.5		
			C4 Pyridines	1.6		
				14.7		
			Alicyclic			
			Aniline	22		
			Methyl Anilines	63		
			(Toluidines)	85		
			Total	100		
				Vol. %		
		IL No. 6	Phenols	3.1	PDU, syncrude mode; rerun naphtha (UOP Sample No. 3531-1-2)	92
			Pyridines	0.8		
			Thiophenes	0.3		
				Wt. %		
		IL No. 6 (Burning Star Mine)	Pyridines	0.19	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)‡	97
			Anilines	0.88		
			Acids	22.3		
		IL No. 6 (Monterey Mine)	Pyridines	0.1	Derived from PDU atmospheric still overhead vacuum still overhead streams, syncrude mode (analyzed by BETC)‡	97
			Anilines	0.7		
			Acids	14.5		

(Continued)

Table 255 (Concluded)

			Value			
Material	Process	Coal Type	Compound Class	Wt. %	Sample Description/Source	Reference
Coal raw naphtha	H-Coal	IL No. 6	Phenol	16	PDU, syncrude mode	109
			Methyl Phenols	55		
			C_2 Phenols	26		
			C_3 Phenols	3		
			Total	100		
		Wyodak	Phenol	26	PDU, syncrude mode	109
			Methyl Phenols	57		
			C_2 Phenols	16		
			C_3 Phenols	1		
			Total	100		
		W.KY No. 11	Phenol	19	PDU, syncrude mode	109
			Methyl Phenols	60		
			C_2 Phenols	19		
			C_3 Phenols	2		
			Total	100		
Hydro-treated coal naphtha	NA	--	--	--	--	--
Coal-derived gasoline	NA	--	--	--	--	--

Explanatory Notes

*All values by MS analysis
†Values by GC/MS analysis
‡See General Comments section, Note 3, for summary of operating conditions used.

Table 256. General Physical and Chemical Properties of Various Distillation Fractions of Primary Coal Naphthas

Material	Process	Coal Type		Distillation Fraction 1	2	3	4	5	6HC*	6	Sample Description/Source	Reference
Coal raw naphtha	SRC-I	Powhattan No. 5	Vapor Temperature, °F								PDU P-99	110
			5% Wt. Off	108	194	237.2	269.6	321.8	320†	374		
			50% Wt. Off	152.6	210.2	249.8	278.6	332.6	325.4	384.8		
			95% Wt. Off	343.4	240.8	257	298.5	348.4	330.8†	399.2		
			Specific Gravity (60°F/60°F)	0.7234	0.7701	0.7696	0.8125	0.8956	0.8827	0.9538		
			Pour Point, °F	<-65.2	<-65.2	<-65.2	<-65.2	<-65.2	NA	<-65.2		
			Molecular Weight Cryoscopic	85	95	108	114	131	NA	126		

Material	Process	Coal Type		Distillation Fraction† BP/180°F	180°F/275°F	275°F/325°F	325/350°F	350°F/370°F	370°F	Sample Description/Source	Reference
	EDS	IL No. 6								One tpd pilot plant, Run YP-258	99
			API Gravity	58.5	50.6	38.2	31.6	26.6	23.3	Operating conditions: Reactor temperature, 840°F; residence time, 40 minutes.	

Material	Process	Coal Type		Distillation Fraction IBP to 180°F	180°F to 400°F	Sample Description/Source	Reference
	H-Coal	IL No.6	API Gravity	66.3	32.3	3 tpd PDU, syncrude mode	98
			Refractive Index (20°C)	NA	1.449		
			Aniline Point, °F	NA	86		

(Continued)

Table 256 (Continued)

			Distillation Fraction				
Material	Process	Coal Type	API Gravity	IBP to 180°F	180°F to 380°F	Sample Description/Source	Reference
Coal raw naphtha	H-Coal	IL No. 6		66.5	36.5	PDU Run 5, syncrude mode, Run 130-82, Period 29	111
			Refractive Index	NA	1.457		
			Heating Value (Btu/lb)	NA	18,278		
			Bromine No. (g/100g)	NA	71.2		
			Distillation Data	NA	186°F-IBP		
					224°F-5		
					238°F-10		
					259°F-20		
					272°F-30		
					286°F-40		
					301°F-50		
					318°F-60		
					330°F-70		
					342°F-80		
					355°F-90		
					368°F-95		
					376°F-EP		
		Wyodak	API Gravity	NA	44.7	PDU Run 6, syncrude mode, Run 130-83, Period 17	112
			Refractive Index	NA	1.4351		
			Heating Value (Btu/lb)	NA	19,540		
			Bromine No. (g/100g)	NA	31.2		
			Distillation Data	NA	189°F-IBP		
					220°F-5		
					240°F-10		
					251°F-20		
					262°F-30		
					274°F-40		
					286°F-50		
					298°F-60		
					315°F-70		
					328°F-80		
					344°F-90		
					356°F-95		
					415°F-EP		

(Continued)

Table 256 (Concluded)

Material	Process	Coal Type		Period 1[§]	Period 2[§]	Period 3[§]	Period 4[§]	Sample Description/Source	Reference
Naphtha from hydrotreated coal liquid	SRC-II	KY No. 9 and 14, IL No. 6 (King River Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	C_5 - 180°F Cut					Ft. Lewis pilot plant, whole SRC-II liquid hydrotreated with ICR 106 catalyst (Run No. 76-165). Operating conditions for Periods 1 through 4, respectively: time on-stream, hr., 251-275, 539-563, 2339-2351, 2709-2733; average catalyst temperature, °F, 750, 750, 768, 776; and LHSV, 0.55, 1.51, 1.52 and 0.49.	86
			API Gravity	60.7	59.9	59.9	58.6		
			Octane Number						
			F-1 clear	81.1	81.5	81.1	82.2		
			F-2 clear	77.0	77.4	NA	NA		
			180 to 300°F Cut						
			API Gravity	51.6	49.0	48.4	49.9		
			Aniline Point, °F	108.8	87.4	79.2	96.8		
			Molecular Weight	107	107	NA	NA		
			Octane Number						
			F-1 Clear	66.0	69.2	72.0	68.4		
			F-2 Clear	66.0	67.3	68.5	66.9		
			TBP Distillation, °F[‡]						
			ST/5	98/177	159/184	147/183	157/183		
			10/30	180/220	203/232	202/232	206/233		
			50	246	252	251	252		
			70/90	269/294	280/302	279/301	277/299		
			95/99	303/NA	310/323	308/319	306/317		
			Distillation[#]						
			ST/5	212/216	214/217	NA	213/217		
			10/30	220/228	220/228		221/228		
			50	235	236		235		
			70/90	246/266	247/270		246/265		
			95/EP	276/321	278/320		274/313		
			% Overhead	99.0	99		99		
Coal-derived gasoline	NA	--			--		--	--	--

Explanatory Notes

[*] Heart cut from secondary fractionation.

[†] Full cut boiling range.

[‡] Distillation simulated by chromatography.

[§] Each period refers to a run time having a characteristic set of operating conditions.

[#] Determined by ASTM D-86.

Table 257. Elemental Composition of Various Distillation Fractions of Primary Coal Naphthas

Material	Process	Coal Type	Boiling Range, °F	Value							Sample Description/Source	Reference
				IBP/200	200/250	250/300	300/325	325/350	350/370	370+		
Coal raw Naphtha	EDS	IL No. 6	Vol % of Sample	20.85	17.40	19.08	12.78	12.10	15.81	1.98	One tpd pilot plant, Run No. YP-221	99
			Wt % of Sample	18.56	16.549	1.876	13.43	13.13	17.36	2.27		
			Composition, Wt %									
			Carbon	85.25	85.76	85.56	84.64	83.95	85.62	83.47		
			Hydrogen	14.32	13.55	12.76	12.39	11.10	11.12	10.69		
			Nitrogen	0.03	0.03	0.02	0.03	0.25	0.16	21.4		
			Sulfur	0.35	0.59	0.99	0.89	0.87	0.46	1.93		
			Oxygen	0.05	0.07	0.67	2.05	3.83	2.64	1.77		
	SRC-II	Powhattan No. 5	Distillation Cut No.	1	2	3	4	5	6		PDU No. P-99	110
			50 Wt % Off Temperature, °F	152.6	210.2	249.8	278.6	332.6	384.8			
			Composition, Wt %									
			Carbon	84.28	86.02	85.73	87.22	83.98	83.56			
			Hydrogen	14.43	13.33	13.66	12.44	10.48	9.49			
			Nitrogen	0.55	0.24	0.27	0.11	0.36	0.82			
			Oxygen	0.67	0.33	0.24	0.08	4.70	6.06			
			Sulfur	0.07	0.08	0.10	0.15	0.48	0.07			
	H-Coal	IL No. 6	Boiling Range, °F		IBP-180°F		180-380°F				PDU Run 5, syncrude mode, Run 130-82, Period 29	111
			Composition, Wt %									
			Carbon		85.38		85.14					
			Hydrogen		14.52		12.00					
			Nitrogen		NA		0.31					
			Oxygen		NA		NA					
			Sulfur		NA		0.38					
		Wyodak	Boiling Range, °F		IBP-180°F		180-380°F				PDU Run 6, syncrude mode, Run 130-83, Period 17	112
			Composition, Wt %									
			Carbon		NA		85.55					
			Hydrogen		NA		13.23					
			Nitrogen		NA		0.13					
			Oxygen		NA		<0.03					
			Sulfur		NA		NA					

(Continued)

Table 257 (Concluded)

Material	Process	Coal Type	Boiling Range, °F	Value IBP/200	200/250	250/300	300/325	325/350	350/370	370+	Sample Description/Source	Reference
Coal raw naphtha	H-Coal	IL No. 6	Boiling Range, °F Composition, Wt %		IBP-180°F		180-380°F				3 tpd PDU, syncrude mode	98
			Carbon		NA		83.6					
			Hydrogen		NA		12.9					
			Nitrogen		NA		0.19					
			Oxygen		<0.07		0.24					
			Sulfur		NA		0.26					
Naphtha from hydro-treated coal liquid	SRC-II	KY No. 9 and 14, IL No. 6 (King River Mine and Pitt-Seams WV (Black-ville No. 2 Mine)	Boiling Range, °F Composition, Wt %				180-300°F				Ft. Lewis pilot plant, Run 130-82, Period 29 whole SRC-II liquid hydrotreated with ICR 106 catalyst (Run No. 76-165). Operating conditions for Periods 1 through 4, respectively: time on-stream, hr., 251-175, 539-563, 2339-2351, 37C9-2733; average catalyst temperature °F, 750, 750, 768, 776, and LHSV, 0.55, 1.51, 1.52 and 0.49.	86
				Period 1*		Period 2*		Period 3*		Period 4*		
			Nitrogen	NA		0.00021		NA		NA		
			Oxygen	NA		0.0280		NA		NA		
Coal-derived gasoline	NA	--	--			--					--	86

Explanatory Note

*Each period refers to a run time having a characteristic set of operating conditions.

Table 258. Hydrocarbon and Oxygen-Containing Compounds and Compound Classes

Material	Process	Coal Type		Value						Sample Description/Source	Reference
			Boiling Range, °F	IBP/200	200/250	250/300	300/325	325/350	350/370		
Coal raw Naphtha	EDS	IL No. 6	MS Compositon, Wt %							One tpd pilot plant, Run No. YP-221	99
			Paraffins	35.00	16.23	18.05	14.68	10.14	4.79		
			Naphthenes	61.73	68.46	45.09	45.57	27.94	17.13		
			Hydrindane	ND	ND	ND	10.12	3.26	0.25		
			Decalin/Methyl Hydrindane	ND	ND	ND	1.09	7.97	25.92		
			Benzene	2.66	0.32	0.21	0.22	0.11	0.18		
			Toluene	0.58	14.82	1.33	0.50	0.24	3.27		
			C_8-Aromatics	0.02	0.16	20.83	4.91	0.20	1.00		
			C_9-Aromatics	0.01	0.01	0.24	12.11	19.69	2.64		
			C_{10}-Aromatics	ND	ND	ND	ND	1.79	11.05		
			C_{11}-Aromatics	ND	ND	ND	ND	ND	ND		
			Indane	ND	ND	ND	0.05	5.51	14.59		
			Tetralin/Methyl-Indane	ND	ND	ND	ND	ND	1.95		
			Methyl-Tetralin/ C_{11}-Indane	ND	ND	ND	ND	ND	ND6		
			Indane	ND	ND	ND	0.16	0.03	0.06		
			Naphthalene	ND	ND	0.05	0.08	0.33	ND		
			Phenol	ND	ND	3.20	10.23	18.67	0.94		
			Cresol	ND	ND	ND	0.22	3.77	15.98		
			Xylenols	ND	ND	ND	0.06	0.35	0.25		
				100.00	100.00	100.00	100.00	100.00	100.00		
			Boiling Range, °F	IBP/180	180/275	275/325	325/350	330/370	370+		
		IL No. 6	MS Compositon, Wt %							One tpd pilot plant, Run No. YP-258	99
			Paraffins	30.64	11.97	8.79	7.73	5.33	4.63		
			Naphthenes	59.71	75.29	54.20	34.19	30.68	18.71		
			Hydrindane	ND	ND	4.58	5.88	2.82	6.10		
			Decalin/Methyl Hydrindane	ND	ND	ND	8.51	ND	3.05		
			Benzene	2.20	0.45	0.04	ND	ND	ND		
			Toluene	0.89	7.23	0.51	0.40	0.89	ND		
			C_8-Aromatics	1.34	4.82	13.30	1.09	1.33	2.02		
			C_9-Aromatics	1.03	0.01	7.35	14.23	3.33	2.25		
			C_{10}-Aromatics	0.71	ND	7.35	4.25	11.93	4.60		
			C_{11}-Aromatics	0.23	ND	ND	ND	0.95	7.84		
			Indane	0.53	ND	0.28	5.69	6.93	2.56		
			Tetralin/Methyl-Indane	1.03	ND	ND	0.75	7.50	22.04		
			Methyl-Tetralin/ C_{11}-Indane	ND	ND	ND	ND	0.52	4.44		
			Indane	0.03	ND	0.10	ND	0.10	0.63		
			Methyl-Indanes	ND	ND	ND	0.16	0.07	0.06		
			Napthalene	ND	ND	0.06	NA	ND	0.34		
			Methyl-Naphthalene	ND	ND	ND	0.15	ND	0.03		
			Phenol	0.32	0.24	10.29	5.02	1.16	0.45		
			Cresol	1.18	ND	0.50	11.55	26.46	8.65		
			Xylenols	0.16	ND	ND	0.40	ND	11.61		
				100.00	100.00	100.00	100.00	100.00	100.00		

(Continued)

Table 258 (Continued)

Material	Process	Coal Type	Boiling Range	Carbon No.	Value (Vol %) Paraffins ISO-	Paraffins Normal	Olefins Alkenes	Olefins CyC5	Olefins Di-	Naphthenes CyC5	Naphthenes CyC6	Aromatics	Sample Description/ Source	Reference
Coal raw naphtha	EDS	IL No. 6	IBP-145°F	4	ND	0.24	0.02	ND	ND	ND	ND	ND	One tpd pilot plant, Run YP-258	99
				5	6.95	27.07	9.50	1.92	1.35	23.76	ND	ND		
				6	5.84	16.22	3.81	2.85	ND	ND	0.06	0.41		
					12.79	43.53	13.33	4.77	1.35	23.76	0.06	0.41		
			145-177°F	5	0.15	0.60	0.22	ND	ND	3.35	ND	ND		
				6	12.22	26.11	7.48	ND	ND	33.69	9.40	6.01		
				7	0.07	ND	ND	ND	ND	ND	ND	ND		
					13.14	26.71	7.70			37.04	9.40	6.01		
			177-207°F	5	ND	0.04	ND	ND	ND	0.09	ND	ND		
				6	0.47	3.46	0.85	0.05	ND	12.27	53.52	3.55		
				7	13.03	1.26	3.01	5.84	ND	0.09	2.15	0.12		
				8	0.14	ND	ND	0.09	ND	ND	ND	ND		
					13.64	4.76	3.86	5.98		12.45	55.64	3.67		

Coal Type	Boiling Range, °F	IBP/202	202/234	234/256	256/278	278/298	298/315	315/330	330/345	345/350	Total	Sample Description/ Source	Reference
Wyodak	Vol % Of Sample	12.11	11.63	11.70	12.01	11.84	11.58	11.70	11.01	5.82	100.00	One tpd pilot plant, Run YP-244	99
	Wt % of Sample	11.18	10.99	11.15	11.75	11.81	11.92	12.35	12.49	6.36	100.00		
	Gravity, °API	54.7	51.0	49.0	44.8	41.2	36.1	31.5	28.3	26.6	40.7		
	MS Analysis (Wt%)												
	Paraffins	35.59	17.77	18.20	15.71	16.04	14.96	13.51	9.89	7.24	16.95		
	Naphthenes	61.98	70.01	68.23	62.59	56.73	47.78	37.69	29.49	24.30	53.74		
	Hydrindane	ND	ND	ND	ND	0.88	5.12	5.93	3.87	2.18	0.57		
	Decalin/Methyl Hydrindane	ND	ND	ND	ND	ND	0.43	4.80	13.59	20.25	2.91		
	Benzene	2.49	0.74	0.33	0.25	0.24	0.29	0.30	0.32	0.32	0.60		
	Toluene	1.92	11.33	7.85	4.00	1.40	0.74	0.83	1.83	2.80	3.86		
	C_8-Aromatics	0.02	0.15	5.38	15.95	16.66	11.05	5.11	1.94	1.15	7.05		
	C_9-Aromatics	ND	ND	0.01	0.12	2.11	7.66	11.19	9.65	6.54	4.11		
	C_{10}-Aromatics	ND	ND	ND	ND	ND	0.08	0.99	3.60	5.93	0.96		
	C_{11}-Aromatics	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
	Indane	ND	ND	ND	ND	ND	0.37	2.49	6.15	7.84	1.58		
	Tetralin/Methyl-Indane	ND	ND	ND	ND	ND	ND	0.14	0.97	2.37	0.33		
	Methyl-Tetralin/ C_{11}-Indane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
	Indene	ND	ND	ND	ND	ND	ND	ND	ND	0.01	0.01		
	Naphthalene	ND	ND	ND	0.03	0.17	0.14	0.19	0.15	0.06	0.02		
	Phenol	ND	ND	ND	1.35	5.77	11.38	16.01	12.87	8.24	6.13		
	Cresol	ND	ND	ND	ND	ND	ND	0.77	5.64	10.64	1.18		
	Xylenols	ND	ND	ND	ND	ND	ND	0.05	0.12	0.13	ND		
		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		

(Continued)

Table 258 (Continued)

Material	Process	Coal Type	Boiling Range, IBP-180°F	Wt %	Sample Description/Source	Reference
Coal raw naphtha	H-Coal	IL No. 6	C_3 hydrocarbon	0.49	PDU Run 5, syncrude mode, Run 130-82, Period 29	111
			1-C_4 hydrocarbon	0.47		
			N-C_4 hydrocarbon	5.89		
			Unidentified hydrocarbon	0.24		
			Unidentified hydrocarbon	0.20		
			Iso-Pentane	3.15		
			N-Pentane	7.36		
			Unidentified hydrocarbon	0.34		
			Unidentified hydrocarbon	0.60		
			2 Methylpentane	3.82		
			3 Methylpentane	2.06		
			Unidentified hydrocarbon	4.99		
			N-Hexane	8.67		
			Methylcyclohexane	13.21		
			Unidentified hydrocarbon	1.98		
			Cyclohexane	24.81		
			Unidentified hydrocarbon	5.84		
			Unidentified hydrocarbon	2.33		
			Unidentified hydrocarbon	3.36		
			Unidentified hydrocarbon	7.61		
			Benzene	2.58		
				100.00		
			Boiling Range, 180-380°F	**Wt %**		
			Paraffins	9.8		
			Monocycloparaffins	32.4		
			Dicycloparaffins	9.8		
			Total	52.0		
			Aliphatic Mono-olefins	0.2		
			Cyclic Mono-olefins	2.1		
			Total	2.3		
			Alkylbenzenes C_6	0.7		
			C_7	7.6		
			C_8	11.2		
			C_9	6.8		
			C_{10}	4.4		
			C_{11}	0.8		
			Total	31.5		
			Alkylindans & Tetralins/C^9	4.2		
			C^{10}	4.9		
			C^{11}	0.6		
			Total	9.7		
			Naphthalene C_{10}	0.2		
			Estimated Phenols	4.3		
			Total	100.0		

(Continued)

Table 258 (Concluded)

Material	Process	Coal Type	Boiling Range, °F IBP-180°F			Wt %		Sample Description/Source	Reference
Coal raw naphtha	H-Coal	Wyodak	Propane			0.77		PDU Run 6, syncrude mode, Run 130-83, Period 17	112
			Isobutane			0.61			
			Normal Butane			5.74			
			Butylene			0.35			
			Iso-Pentane			4.17			
			N-Pentane			11.18			
			Pentenes			1.39			
			2 Methylpentane			3.05			
			3 Methylpentane			5.56			
			Cyclopentene			6.32			
			N-Hexane			12.57			
			Methylcyclopentane			11.05			
			Cyclohexane			20.80			
			C_6 and C_7 hydrocarbons			16.44			
						100.00			
			Boiling Range, °F 180-380°F			Vol %	Wt %		
			Paraffins			18.2	16.3		
			Monocycloparaffins			41.6	40.4		
			Dicycloparaffins			9.1	9.1		
			Total			68.9	65.9		
			Aliphatic Mono-olefins			1.5	1.4		
			Cyclic Mono-olefins			3.0	3.0		
			Total			4.5	4.4		
			Alkylbenzenes C_6			0.4	0.5		
			C_7			4.4	4.7		
			C_8			7.0	7.5		
			C_9			5.5	6.0		
			C_{10}			3.6	3.9		
			C_{11}			0.2	0.2		
			Total			21.1	22.8		
			Alkylindans & Tetralins/C_9			3.0	3.6		
			C_{10}			2.3	2.8		
			C_{11}			0.1	0.1		
			Total			5.4	6.5		
			Naphthalene C_{10}			0.1	NA		
Naphtha from Hydro treated coal liquid	SRC-II	KY No. 9 and 14, IL No. 6 (King River Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	Boiling Range, °F 180-300°F	Period 1	Period 2	Period 3	Period 4	Ft. Lewis pilot plant, whole SRC-II liquid hydrotreated with ICR 106 catalyst (Run No. 76-165). Operating conditions for Periods 1 through 4, respectively: time on-stream, hr., 251-275, 529-563, 2399-2351, 2709-2733; average catalyst temperature, °F, 750, 750, 768, 776; and LHSV, 0.55, 1.51, 1.52 and 0.49.	86
			Saturates	97.2	85.9	80.6	89.6		
			Aromatics	3.8	14.1	19.4	10.4		
Coal-derived gasoline	NA	--	--		--			--	--

Table 259. General Physical and Chemical Properties of Non-Primary Coal Naphthas

Material	Process	Coal Type	Value			Sample Description/Source	Reference
			Distillation	% Evaporation	Temperature (°F)		
Coal raw naphtha	NA	--	--	--	--	--	--
Naphtha from hydrotreated coal liquid	EDS	IL No. 6 (Monterey Mine)	Specific Gravity*	0.7699	--	Blend of product from series flow from hydrocracking of gas oil feed from one tpd pilot plant; hydrocracking performed in bench-scale continuous hydrocracking unit (UOP Sample No. 3532-23, UOP Research Plant 601, Run 777). Operating conditions: 500 psig above base pressure.	87
			API Gravity, °	52.3			
			Distillation, °F				
			IBP	148			
			5%	170			
			10%	181			
			20%	200			
			30%	215			
			40%	229			
			50%	224			
			60%	260			
			70%	280			
			80%	302			
			90%	324			
			95%	338			
			EP	372			
			% Over	98.5			
			% Bottoms	1.5			
			Research Octane No., Clear	75.2			
			Bromine Index	369			
			Molecular Weight	102			

(Continued)

Table 259 (Continued)

Material	Process	Coal Type	Value		Sample Description/Source	Reference
Naphtha from hydro-treated coal liquid	EDS	IL No. 6 (Monterey Mine)	Specific Gravity*	0.7796	Blend of product from hydrocracking of gas oil feed from one tpd pilot plant; hydrocracking performed in bench-scale continuous hydrocracking unit (UOP Sample No. 3532-26. UOP Research Plant 601. Run 779). Operating conditions; 500 psig above base pressure.	87
			API. Gravity, °	50.0		
			Distillation, °F	% Evaporation		
			IBP	138		
			5%	160		
			10%	170		
			20%	191		
			30%	207		
			40%	222		
			50%	236		
			60%	253		
			70%	273		
			80%	296		
			90%	318		
			95%	331		
			EP	392		
			% Over	98.0		
			% Bottoms	2.0		
			Research Octane No., Clear	83.2		
			Bromine Index	344		
			Molecular Weight Average	100		

(Continued)

Table 259 (Continued)

Material	Process	Coal Type	Value		Sample Description/Source	Reference
Naphtha from hydro-treated coal liquid	H-Coal	IL No. 6	Specific Gravity*	0.7809	From moderate hydrocracking of gas oil feed from 3 tpd PDU operated in syncrude mode; hydrocracking performed in bench-scale continuous hydrocracking unit (UOP Sample No. 3531-15, UOP Research Plant 601, Runs 749 and 751). Operating conditions: 500 psig below base pressure.	92
			API Gravity, °	49.7		
			Distillation, °F	%Evaporation		
			IBP	120		
			5%	148		
			10%	162		
			20%	184		
			30%	202		
			40%	218		
			50%	233		
			60%	250		
			70%	269		
			80%	289		
			90%	319		
			95%	336		
			EP	400		
			% Over	99.0		
			% Bottoms	1.0		
			Research Octane No., Clear	84.2		
			Bromine Index	298		

(Continued)

Table 259 (Concluded)

Material	Process	Coal Type	Value		Sample Description/Source	Reference
Naphtha from hydrotreated coal liquid	H-Coal	IL No. 6	Specific Gravity*	0.7822	From moderate hydrocracking of gas oil feed from 3 tpd PDU operated in syncrude mode; hydrocracking performed in bench-scale continuous hydrocracking unit (UOP Sample No. 3531-18, UOP Research Plant 601, Runs 756 and 757). Operating conditions: 500 psig above base pressure.	92
			API Gravity, °	49.4		
			Distillation, °F	**% Evaporation**		
			IBP	127		
			5%	156		
			10%	172		
			20%	194		
			30%	213		
			40%	231		
			50%	248		
			60%	262		
			70%	288		
			80%	311		
			90%	342		
			95%	375		
			EP	518		
			% Over	98.5		
			% Bottoms	1.5		
			Research Octane No., Clear	80.2		
			Bromine Index	126.0		
Coal-derived gasoline			See Table 2 of Part VI			

Explanatory Notes

*Measured at 60°F

†Distillation simulated by chromatography

Table 260. General Physical and Chemical Properties of Gasolines Derived From Non-Primary Coal Naphthas

Material	Process	Coal Type		Value						Sample Description/Source	Reference
				Period 1*	Period 2*	Period 3*	Period 4*	Period 5*	Period 6*		
Coal-derived gasoline	EDS	IL No. 6 (Monterey Mine)	API Gravity†	45.9	43.8	43.9	41.1	43.7	42.4	From platforming of hydrocracked gas oil sample No. 3532-23 (UOP Research Plant 636, Run 321). Operating conditions for Periods 1 through 6, respectively: P-P (base), psig, 0 (all periods); T-T (base), °C, -118, -103, -85, -43, -73, -58; LHSV/LHSV (base), 1.49, 1.45, 1.54, 1.52, 1.51 and 1.45.	87
			Specific Gravity†	0.7976	0.8072	0.8067	0.8198	0.8076	0.8137		
			Distillation, °F†								
			IBP	142	140	144	135	144	150		
			5%	164	162	162	160	164	166		
			10%	174	172	173	171	176	178		
			30%	212	206	213	216	217	220		
			50%	250	237	255	256	258	262		
			70%	291	270	293	296	303	304		
			90%	340	320	344	347	352	356		
			95%	360	330	364	367	376	391		
			EP	382	382	382	405	398	418		
			Research Octane No., Clear	91.2	93.8	96.0	99.8	96.9	98.4		
		IL No. 6 (Monterey Mine)	API Gravity†	47.3	46.7	45.8	44.4	42.7	41.8	From platforming of hydrocracked gas oil sample No. 3532-26 (UOP Research Plant 636, Run 334). Operating conditions for Periods 1 through 6, respectively: P-P (base), psig, 0 (all periods); T-T (base), °C periods); T-T (base), °C, -154, -147, -133, -108, -88, -67; LHSV/LHSV (base), 1.57, 1.50, 1.52, 1.50, 1.46 and 1.45.	87
			Specific Gravity†	0.7914	0.7941	0.7981	0.8044	0.8123	0.8165		
			Distillation, °F†								
			IBP	140	150	142	140	142	140		
			5%	160	160	164	162	164	162		
			10%	172	170	175	172	177	174		
			30%	206	204	209	210	214	212		
			50%	238	238	242	246	250	251		
			70%	280	278	280	286	288	290		
			90%	328	326	328	334	334	336		
			95%	343	341	346	352	352	359		
			EP	357	356	364	368	372	382		
			Research Octane No., Clear	90.4	91.3	93.4	96.0	98.2			

(Continued)

Table 260 (Continued)

Material	Process	Coal Type		Value Period 1*	 Period 2*	 Period 3*	 Period 4*	 Period 5*	 Period 6*	 Period 7*	Sample Description/ Source	Reference
Coal-derived gasoline	EDS	IL No. 6 (Monterey Mine)	API Gravity†	44.3	41.0	45.2	46.2	42.3	41.7	40.5	From platforming of moderately hydrocracked gas oil. Sample No. 3531-15 (UOP Research Plant 508, Run 1457). Operating condiitions for Periods 1 through 7, respectively: P-P (base), psig, 0 (all periods); T-T (base), °C, -78, -103, -118, -133, -78, -58, -38; LHSV/LHSV (base), 1.50, 1.51, 1.45, 1.45, 1.49, 1.53, 1.47.	92
			Specific Gravity†	0.8049	0.82083	0.8008	0.7963	0.8134	0.8170	0.8227		
			Distillation, °F‡									
			IBP	140	152	132	140	138	126	134		
			5%	160	170	152	162	160	150	154		
			10%	174	180	165	173	171	176	167		
			30%	201	216	201	208	209	208	212		
			50%	245	253	235	241	247	245	252		
			70%	290	297	277	282	285	287	289		
			90%	344	351	331	336	346	340	348		
			95%	380	375	350	362	367	360	372		
			EP	424	427	410	430	429	418	448		
			Research Octane No., Clear	98.9	96.6	93.7	91.6	98.3	99.6	101.2		
				Period 1*	Period 2*	Period 3*	Period 4*	Period 5*				
			API Gravity†	45.4	44.1	43.4	41.9	40.0			From platforming of moderately hydrocracked gas oil. Sample No. 3531-18 (UOP Research Plant 508, Run 1458). Operating condiitions for Periods 1 through 5, respectively: P-P (base), psig, 0 (all periods); T-T (base), °C, -118, -98, -78, -53, -13; LHSV/LHSV (base), 1.48, 1.49, 1.50, 1.49, 1.50.	92
			Specific Gravity†	0.7999	0.8053	0.8090	0.8160	8.251				
			Distillation, °F‡									
			IBP	134	143	140	132	142				
			5%	159	165	160	159	169				
			10%	172	178	175	173	183				
			30%	214	216	217	217	226				
			50%	248	252	255	257	260				
			70%	291	296	299	301	303				
			90%	342	349	356	354	363				
			95%	379	399	392	381	420				
			EP	524	524	510	461	440				
			Research Octane No., Clear	90.6	93.6	95.6	98.1	99.3				

(Continued)

Table 260 (Concluded)

Material	Process	Coal Type	Value		Sample Description/Source	Reference
Coal-derived gasoline	H-Coal	NA	API Gravity†	51.8 - 53.4	From series flow second stage hydrocracking of mildly hydrocracked gas oil Sample No. 96-3330A (Chevron Plant 536, Run 678). Operating conditions: P-P (base), psi, -500; LHSV/LHSV (base), 1.0; CPR/CPR (base), 1.18; T-T (base), °F, 47-49.	94
			Research Octane No., Clear	91.5		
			Distillation, °F			
			IBP	82-107		
			10%	122-127		
			50%	244-232		
			90%	350-359		
			EP	385-393		
		NA	API Gravity†	48.8-51.0	From simple flow second stage hydrocracking of heavily hydrocracked gas oil Sample No. 96-3330A (Chevron Plant 601, Runs 749-751). Operating conditions: P-P (base), psi, -500; LHSV/LHSV (base), 0.725-1.45; CPR/CPR (base), 1.25; T-T (base), °F, 20-50.	94
			Research Octane No. Clear	NA		
			Distillation, °F			
			IBP	30-70		
			10%	77-158		
			50%	215-242		
			90%	320-340		
			EP	365-459		
		NA	API Gravity†	43.1-45.2	From fluid catalytic cracking of moderately hydrotreated Sample No. 37-1117/8 (UOP Research Plant 593, Run 255, Periods 1 through 5*. Operating conditions P-P (base), psi, -10; LHSV/LHSV (base), 1.03-1.56; T-T (base), °F, 2-47.	93
			Research Octane No. Clear	95.5-96.9		
			Distillation, °F			
			IBP	120-130		
			10%	157-161		
			50%	230-245		
			90%	344-336		
			EP	410-422		

Explanatory Notes

*Each period refers to a run time having a characteristic set of operating conditions.

†Measured at 69°F

‡Determined by ASTM D-86

Table 261. Elemental Composition of Non-Primary Coal Naphthas and Gasoline

Material	Process	Coal Type	C	H	N	O	S	Sample Description/Source	Reference
Coal raw naphtha	NA	--	--	--	--	--	--	--	--
Naphtha from hydrotreated coal liquids	EDS	IL No. 6 (Monterey Mine)	85.63	13.74	0.00003	0.0378	0.00003	Blend of product from series flow from hydrocracking of gas oil feed from one tpd pilot plant; hydrocracking performed in bench-scale continuous hydrocracking unit (UOP Sample No. 3532-23, UOP Research Plant 601, Run 777). Operating conditions: 500 psig above base pressure.	87
		IL No. 6 (Monterey Mine)	86.70	12.84	0.00003	0.0237	0.00013	Blend of product from hydrocracking of gas oil feed from one tpd pilot plant; hydrocracking performed in bench-scale continuous hydrocracking unit (UOP Sample No. 3532-26, UOP Research Plant 601, Run 779). Operating conditions: 500 psig above base pressure.	87
	H-Coal	IL No. 6	86.52	13.09	0.00001	0.00409	0.0001	From moderate hydrocracking of gas oil feed from 3 tpd PDU operated in syncrude mode; hydrocracking performed in bench-scale continuous hydrocracking unit (UOP Sample No. 3531-15, UOP Research Plant 601, Runs 749 and 751). Operating conditions: 500 psig below base pressure.	92
		IL No. 6	86.13	13.47	0.000013	0.00409	0.00082	From moderate hydrocracking of gas oil feed from 3 tpd PDU operated in syncrude mode; hydrocracking performed in bench-scale continuous hydrocracking unit (UOP Sample No. 3531-18, UOP Research Plant 601, Runs 756 and 757). Operating conditions: 500 psig below base pressure.	92

(Continued)

Table 261 (Concluded)

Material	Process	Coal Type	Composition, Wt%	Period 1*	Period 2*	Period 3*	Period 4*	Period 5*	Period 6*	Period 7*	Sample Description/Source	Reference
Coal-derived gasoline	EDS	IL No. 6 (Monterey Mine)	Carbon	87.34	87.74	88.73	89.60	87.80	88.83	NA	From platforming of hydrocracked gas oil Sample No. 3532-23 (UOP Research Plant 636, Run 321). Operating conditions for Periods 1 through 6, respectively: P-P (base), psig, 0 (all periods); T-T (base), °C, -110, -103, -85, -43, -73, -58; LHSV/LHSV (base), 1.49, 1.45, 1.54, 1.52, 1.51 and 1.46.	87
			Hydrogen	12.31	12.03	12.01	11.20	11.73	11.34	NA		
			Nitrogen	0.00003	0.00001	0.00003	0.00001	0.00001	0.00006	NA		
			Sulfur	<0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	NA		
			Oxygen	0.0245	0.0358	0.0327	0.0336	0.0383	0.0326	NA		
		IL No. 6 (Monterey Mine)	Carbon	87.17	87.06	86.95	88.57	87.86	88.01	NA	From platforming of hydrocracked gas oil Sample No. 3532-26 (UOP Research Plant 636, Run 334). Operating conditions for Periods 1 through 6, respectively: P-P (base), psig, 0 (all periods); T-T (base), °C, -154, -147, -133, -108, -88, -67; LHSV/LHSV (base), 1.67, 1.50, 1.52, 1.50, 1.46 and 1.45	87
			Hydrogen	12.41	12.36	12.06	11.97	11.77	11.19	NA		
			Nitrogen	0.00003	0.00003	0.00003	0.00001	0.00003	0.00001	NA		
			Sulfur	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	NA		
			Oxygen	NA	0.00832	0.0151	0.0219	0.0272	NA	NA		
	H-Coal	IL No. 6	Carbon	88.33	87.50	88.26	88.07	88.81	88.65	88.66	From platforming of hydrocracked gas oil Sample No. 3531-15 (UOP Research Plant 508, Run 1457). Operating conditions for Periods 1 through 7, respectively: P-P (base), psig, 0 (all periods); T-T (base), °C, -78, -103, -118, -133, -78, -58, -38; LHSV/LHSV (base), 1.50, 1.51, 1.45, 1.45, 1.49, 153, 1.47.	92
			Hydrogen	11.92	12.33	12.42	12.70	11.50	10.89	10.48		
			Nitrogen	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001		
			Sulfur	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001		
		IL No. 6	Carbon	87.75	87.86	87.67	88.52	89.26	NA	NA	From platforming of hydrocracked gas oil Sample No. 3531-18 (UOP Research Plant 508, Run 1458). Operating conditions for Periods 1 through 5, respectively: P-P (base), psig, 0 (all periods); T-T (base), °C, -118, -98, -78, -53, -13; LHSV/LHSV (base), 1.48, 1.49, 1.50, 1.49, 1.60.	92
			Hydrogen	12.39	11.99	11.57	11.42	10.95	NA	NA		
			Nitrogen	0.00001	0.00001	0.00001	0.00001	0.00001	NA	NA		
			Sulfur	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	NA	NA		
			C	H	N		O	S				
Coal-derived gasoline	H-Coal	NA	NA	NA	0.00001-0.0001		0.00915-0.00936	0.00117-0.00320			From series flow second stage hydrocracking of mildly hydrocracked gas oil Sample No. 96-3330A (Chevron Plant 536, Run 678). Operating conditions: P-P (base) psi; -500; LHSV/LHSV (base), 1.0; CPR/CPR (base), 1.10; T-T (base), °F, 47-49.	94

Table 262. Hydrocarbon Class Properties of Non-Primary Coal Naphthas and Gasoline

Material	Process	Coal Type	Value, Vol %*			Sample Description/Source	Reference
			Aromatics	Saturates	Olefins		
Coal raw naphtha	NA	--	--	--	--	--	--
Naphtha from hydro-treated coal liquids	EDS	IL No. 6 (Monterey Mine)	14.2	85.8	NA	Blend of product from series flow from hydrocracking of gas oil feed from one tpd pilot plant; hydrocracking performed in bench-scale continuous hydrocracking unit (UOP Sample No. 3532-23, UOP Research Plant 601, Run 777). Operating conditions: 500 psig above base pressure.	87
		IL No. 6 (Monterey Mine)	27.3	72.7	NA	Blend of product from hydrocracking of gas oil feed from one tpd pilot plant; hydrocracking performed in bench-scale continuous hydrocracking unit (UOP Sample No. 3532-26, UOP Research Plant 601, Run 779). Operating conditions: 500 psig above base pressure.	87
	H-Coal	IL No. 6	34.43	65.57	NA	From moderate hydrocracking of gas oil feed from 3 tpd PDU operated in syncrude mode; hydrocracking performed in bench-scale continuous hydrocracking unit (UOP Sample No. 3531-15, UOP Research Plant 601, Runs 749 and 751). Operating conditions: 500 psig below base pressure.	92
		IL No. 6	23.26	76.74	NA	From moderate hydrocracking of gas oil feed from 3 tpd PDU operated in syncrude mode; hydrocracking performed in bench-scale continuous hydrocracking unit (UOP Sample No. 3531-18, UOP Research Plant 601, Runs 756 and 757). Operating conditions: 500 psig below base pressure.	92

(Continued)

Table 262 (Continued)

Material	Process	Coal Type	Compound Class	Value (Vol. %)* Period 1†	Period 2†	Period 3†	Period 4†	Period 5†	Period 6†	Period 7†	Sample Description/Source	Reference
Coal derived gasoline	EDS	IL No. 6 (Monterey Mine)	Paraffins	19.71	18.65	18.80	17.21	20.69	19.40	NA	From platforming of hydrocracked gas oil Sample No. 3532-23 (UOP Research Plant 636, Run 321). Operating conditions for Periods 1 through 6, respectively: P-P (base), psig, 0 (all periods); T-T (base), °C, -118, -103, -85, -43, -73, -58; LHSV/LHSV (base), 1.49, 1.45, 1.54, 1.52, 1.51 and 1.45.	87
			Naphthenes									
			Monocycloparaffins	24.14	20.36	16.61	6.85	14.68	10.82	NA		
			Bi, Dicyclo-paraffins	4.40	3.55	21.9	0.46	1.75	0.69	NA		
			Tricycloparaffins	0.12	0.00	0.00	0.00	0.00	0.00	NA		
			Aromatics									
			Alkylbenzenes	48.19	37.74	57.15	71.45	58.67	65.29	NA		
			Indans, Tetralins	3.28	3.55	3.42	3.49	3.91	3.52	NA		
			Naphthalenes	0.16	0.15	0.14	0.54	0.29	0.28	NA		
			Total	100.00	100.00	100.00	100.00	100.00	100.00	NA		
		IL No. 6 (Monterey Mine)	Paraffins	NA	16.63	16.63	15.39	16.42	16.53	NA	From platforming of hydrocracked gas oil Sample No. 3532-26 (UOP Research Plant 636, Run 334). Operating conditions for Periods 1 through 6, respectively: P-P (base), psig, 0 (all periods); T-T (base), °C, -154, -147, -133, -108, -88, -67; LHSV/LHSV (base), 1.57, 1.50, 1.52, 1.50, 1.46 and 1.45.	87
			Naphthenes									
			Monocycloparaffins	NA	27.93	25.15	16.21	13.43	8.98	NA		
			Bi, Dicyclo-paraffins	NA	5.75	4.29	3.76	0.73	0.75	NA		
			Tricycloparaffins	NA	0.00	0.00	0.00	0.00	0.00	NA		
			Aromatics									
			Alkylbenzenes	NA	46.75	50.54	60.19	65.85	69.85	NA		
			Indans, Tetralins	NA	2.94	3.37	4.37	3.54	3.76	NA		
			Naphthalenes	NA	0.00	0.02	0.08	0.03	0.13	NA		
			Total	NA	100.00	100.00	100.00	100.00	100.00	NA		
	H-Coal	IL No. 6	Paraffins	15.66	NA	NA	9.56	NA	NA	13.14	From platforming of hydrocracked gas oil Sample No. 3531-15 (UOP Research Plant 508, Run 1457). Operating conditions for Periods 1 through 7, respectively: P-P (base), psig, 0 (all periods); T-T (base), °C, -78, -103, -118, -133, -78, -58, -38; LHSV/LHSV (base), 1.50, 1.51, 1.45, 1.45, 1.49, 1.53, 1.47.	92
			Naphthenes									
			Monocycloparaffins	12.58	NA	NA	26.69	NA	NA	6.08		
			Bi, Dicyclo-paraffins	1.26	NA	NA	4.20	NA	NA	0.59		
			Tricycloparaffins	0.0	NA	NA	0.13	NA	NA	0.0		
			Aromatics									
			Alkylbenzenes	65.86	NA	NA	52.23	NA	NA	75.45		
			Indans, Tetralins	4.35	NA	NA	6.73	NA	NA	4.29		
			Naphthalenes	0.29	NA	NA	0.46	NA	NA	0.45		
			Total	100.00	NA	NA	100.00	100.00	100.00	NA		
		IL No. 6	Paraffins	15.03	16.65	15.27	15.13	10.57	NA	NA	From platforming of hydrocracked gas oil Sample No. 3531-18 (UOP Research Plant 508, Run 1458). Operating conditions for Periods 1 through 5, respectively: P-P (base), psig, 0 (all periods); T-T (base), °C, -118, -98, -78, -53, -13; LHSV/LHSV (base) 1.48, 1.49, 1.50, 1.49, 1.50.	92
			Naphthenes									
			Monocycloparaffins	31.35	25.91	21.30	13.64	7.15	NA	NA		
			Bi, Dicyclo-paraffins	7.09	4.69	3.32	2.19	0.99	NA	NA		
			Tricycloparaffins	0.0	0.23	0.21	0.00	0.00	NA	NA		
			Aromatics									
			Alkylbenzenes	41.76	47.26	54.20	62.94	73.11	NA	NA		
			Indans, Tetralins	4.25	4.70	5.05	5.26	6.24	NA	NA		
			Naphthalenes	0.52	0.56	0.65	0.84	1.94	NA	NA		
			Total	100.00	100.00	100.00	100.00	100.00	NA	NA		

(Continued)

Table 262 (Concluded)

				Value, Vol %*			
Material	Process	Coal Type	Aromatics	Saturates	Olefins	Sample Description/Source	Reference
Coal-derived gasoline	H-Coal	NA	29.1-34.3	65.7-70.9	0.0-0.0	From series flow second stage hydrocracking of mildly hydrocracked gas oil Sample No. 96-3330A (Chevron Plant 536, Run 678). Operating conditions: P-P (base), psi, -500; LHSV/LHSV (base), 1.0; CPR/CPR (base), 1.18; T-T (base), °F, 47-49.	94
		NA	23.6-35.7	64.3-76.4	0.0-0.0	From simple flow second stage hydrocracking of heavily hydrocracked gas oil Sample No. 96-3330A (Chevron Plant 601, Runs 749-751). Operating conditions: P-P (base), psi, -500; LHSV/LHSV (base), 0.725-1.45; CPR/CPR (base), 1.25; T-T (base), °F, 20-50.	94
		NA	45.2-50.7	44.5-49.5	4.2-6.2	From fluid catalytic cracking of moderately hydrotreated Sample No. 37-1117/8 (UOP Research Plant 593, Run 225, Periods 1 through 5). Operating conditions: P-P (base), psi, -10; LHSV/LHSV (base), 1.03-1.56; T-T (base), °F 2-47.	93

Explanatory Notes:

*All values by Mass Spectrometry except for values from References 94 and 93 which are by flame ionization analysis.

†Each period refers to a run time having a characteristic set of operating conditions.

Table 263. General Physical and Chemical Properties of Various Distillation Fractions of Non-Primary Coal Naphthas and Gasolines

Material	Process	Coal Type	Value					Sample Description/Source	Reference
				Period 1*	Period 2*	Period 3*	Period 4*		
Coal raw naphtha	NA	--		--				--	--
Naphtha from hydrotreated coal liquid	SRC-II	KY No. 9 and 14, IL No. 6 (King River Mine), and Pitt-Seams WV (Blackville No. 2 Mine)	C_5 - 180°F Cut					Ft. Lewis pilot plant, 400°F+ SRC-II liquid hydrotreated with ICR 106 catalyst (Run No. 76-166). Operating conditions for Periods 1 through 4 respectively: time on-stream, hr., 145-169, 169-193, 313-337, 337-361; average catalyst temperature, °F, 746, 751, 752, 752; LHSV, 0.55, 0.43, 0.99 and 0.99.	86
			API Gravity	66.0	63.3	66.8	63.1		
			Heavy Naphtha						
			Boiling range, °F	180-350	180-400	180-350	180-400		
			API Gravity	47.3	42.3	46.3	39.7		
			Aniline Point, °F	109.7	110.0	89.9	84.9		
			Octane No. F-1 Clear	58.8	54.4	64.5	63.8		
			TBP Distillation, °F†						
			ST/5	102/185	134/214	138/185	153/214		
			10/30	218/233	221/273	218/242	222/273		
			50	275	332	279	323		
			70/90	307/341	372/396	311/345	370/398		
			95/99	350/364	402/410	352/363	407/416		
			Distillation‡						
			ST/5	224/231	NA	NA	233/245		
			10/30	235/249	NA	NA	254/282		
			50	264	NA	NA	314		
			70/90	285/313	NA	NA	342/366		
			95/EP	325/373	NA	NA	375/414		
			% Overhead	98	NA	NA	99		
			% Trap	1	NA	NA	0		
			%in Flask	1	NA	NA	1		
			Viscosity, cSt, 100°F	NA	NA	0.7964	NA		

(Continued)

Table 263 (Continued)

Material	Process	Coal Type	Value					Sample Description/Source	Reference
Naphtha from hydro-treated coal liquid	H-Coal	IL No. 6	Boiling Range, °F	C_5-180	180-250	250-300	300-350	From hydrotreating of H-Coal syncrude feed (boiling range 140-704°F) from PDU Run 5 operated in syncrude mode, over fresh ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-171, Hours 222-246). Operating conditions: catalyst temperature, 750°F; LHSV, 1.0	95
			API Gravity	64.6	53.9	50.3	43.2		
			Research Octane No.	78.8	NA	NA	NA		
			TBP Distillation, °F						
			ST/5	39/76	55/177	208/246	253/293		
			10/30	91/151	181/214	250/263	299/317		
			50	165	226	278	329		
			70/90	179/187	232/250	287/303	344/355		
			95/EP	189/212	256/266	308/319	360/367		
		IL No. 6	Boiling Range, °F	C_5-180	180-250			From hydrotreating of rerun H-Coal syncrude feed from PDU Run 5 operated in syncrude mode over fresh ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-173, Hours 463-475). Operating conditions: catalyst temperature, 748°F; LHSV, 1.5.	95
			API Gravity	63.0	52.0				
			TBP Distillation, °F†						
			ST/5	NA	211/257				
			10/30	NA	273/338				
			50	NA	382				
			70/90	NA	428/496				
			95/EP	NA	519/575				
		Wyodak	Boiling Range, °F	C_5-180	180-250	250-300	300-350	From hydrotreating of H-Coal syncrude feed (boiling range 120-650°F) from PDU Run 6 operated in syncrude mode, over fresh ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-173, Hours 331-355). Operating conditions: catalyst temperature, 752°F; LHSV, 1.0.	95
			API Gravity	65.8	54.8	51.3	44.3		
			Research Octane No.	79.0	70.0	NA	NA		
			TBP Distillation, °F†						
			ST/5	23/83	154/178	210/246	253/295		
			10/30	98/157	181/207	250/263	301/318		
			50	168	223	278	329		
			70/90	182/188	230/249	286/304	343/354		
			95/EP	190/200	255/264	308/319	360/369		

(Continued)

Table 263 (Continued)

Material	Process	Coal Type	Value			Sample Description/Source	Reference
Naphtha from hydro-treated coal liquid	H-Coal	IL No. 6	Boiling Range, °F	C_5-180	180-250	From hydrotreating of H-Coal syncrude feed (boiling range 140-704°F) from PDU Run 5 operated in syncrude mode, over aged ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-171, Hours 3191-3215). Operating conditions: catalyst temperature, 774°F; LHSV, 0.5.	95
			API Gravity	64.0	52.7		
			Research Octane No.	82.0	NA		
			Motor Octane No.				
			TBP Distillation, °F†				
			ST/5	25/79	200/204		
			10/30	97/161	206/207		
			50	171	210		
			70/90	179/186	212/220		
			95/EP	187/194	227/255		
		IL No. 6	Boiling Range, °F	C_5-180	180-250	From hydrotreating of rerun H-Coal syncrude feed from PDU Run 5 operated in syncrude mode, over aged ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-174, Hours 76-174). Operating conditions: catalyst temperature, 802°F; LHSV, 1.5.	95
			API Gravity	65.0	53.1		
			Motor Octane No.	NA	73.1		
			TBP Distillation, °F†				
			ST/5	NA	195/197		
			10/30	NA	198/200		
			50	NA	202		
			70/90	NA	208/219		
			95/EP	NA	231/279		
		Wyodak	Boiling Range, °F	C_5-180	180-250	From hydrotreating of H-Coal syncrude feed (boiling range 120-650°F) from PDU Run 6 operated in syncrude mode, over aged ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-174, Hours 208-232). Operating conditions: catalyst temperature, 802°F; LHSV, 1.0.	95
			API Gravity	66.8	54.2		
			TBP, Distillation, °F†				
			ST/5	NA	155/179		
			10/30	NA	184/208		
			50	NA	225		
			70/90	NA	234/252		
			95/EP	NA	257/267		

(Continued)

Table 263 (Continued)

Material	Process	Coal Type		Value				Sample Description/Source	Reference
Naphtha from hydrotreated coal liquid	H-Coal	Wyodak	Boiling Range, °F	C_5-180	180-250	250-300	300-350	From hydrotreating of rerun H-Coal syncrude feed from PDU Run 6 operated in syncrude mode, over aged ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-174, Hours 604-610). Operating conditions: catalyst temperature, 803°F; LHSV, 1.5.	95
			API Gravity	69.2	56.4	50.5	43.5		
			TBP, Distillation, °F†						
			ST/5	44/84	45/143	205/241	257/292		
			10/30	99/156	161/184	248/265	299/318		
			50	173	214	278	330		
			70/90	189/221	224/248	288/304	344/356		
			95/EP	225/250	262/298	309/319	362/371		
		IL No. 6	Boiling Range, °F	C_5-180	180-250	250-300	300-350	From moderate hydrotreating of H-Coal syncrude feed (boiling range 140-704°F) from PDU Run 5 operated in syncrude mode, over ICR 106 catalyst for production of heating oil (Chevron Run 76-171, Hours 1967-1991). Operating conditions: catalyst temperature, 775°F; LHSV, 1.5.	95
			API Gravity	61.6	51.8	45.9	39.9		
			TBP Distillation, °F†						
			ST/5	46/90	157/179	212/245	252/291		
			10/30	101/161	183/218	251/273	300/320		
			50	176	226	283	332		
			70/90	188/195	235/250	293/305	345/357		
			95/EP	198/208	256/269	311/321	362/367		
		Wyodak	Boiling Range, °F	C_5-180	180-250			From moderate hydrotreating of H-Coal syncrude feed (boiling range 120-650°F) from PDU Run 6 operated in syncrude mode, over ICR 113 catalyst for production of heating oil (Chevron Run 66-203, Hours 1366-1390). Operating conditions: catalyst temperature, 747°F; LHSV, 1.5.	95
			API Gravity	65.0	54.2				
			Research Octane No.	NA	71.3				
			TBP Distillation, °F†						
			ST/5	NA	200/203				
			10/30	NA	204/206				
			50	NA	209				
			70/90	NA	213/220				
			95/EP	NA	227/264				

(Continued)

Table 263 (Concluded)

Material	Process	Coal Type	Value					Sample Description/Source	Reference
Naphtha from hydro-treated coal liquid	H-Coal	IL No. 6	Boiling Range, °F	C_5-180	180-250	250-300	300-350	From moderate hydrotreating of H-Coal syncrude feed (boiling range 140-704°F) from PDU Run 5 operated in syncrude mode, over ICR 106 catalyst for production of fuel oil (Chevron Run 76-171, Hours 654-678). Operating conditions: catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2493 psig; hydrogen pressure, 2231 psia.	95
			API Gravity	64.7	51.9	46.1	39.9		
			TBP Distillation, °F†						
			ST/5	52/85	101/176	211/245	264/294		
			10/30	99/155	179/216	251/272	302/319		
			50	167	220	284	327		
			70/90	178/187	227/242	294/306	340/352		
			95/EP	191/194	251/279	312/322	358/367		
		IL No. 6	Boiling Range, °F	C_5-180	180-250	250-300	300-350	From moderate hydrotreating of H-Coal syncrude feed (boiling range 140-704°F) from PDU Run 5 operated in syncrude mode, over ICR 106 catalyst for production of fuel oil (Chevron Run 76-171, Hours 1535-1559). Operating conditions: catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2001 psig; hydrogen pressure, 1778 psia.	95
			API Gravity	62.2	51.8	46.0	39.6		
			TBP Distillation, °F†						
			ST/5	107/130	201/204	210/246	243/286		
			10/30	136/148	206/209	252/272	298/321		
			50	157	210	283	334		
			70/90	163/170	214/220	293/206	348/361		
			95/EP	173/307	226/281	312/323	365/372		
		IL No. 6	Boiling Range, °F	C_5-180	180-250	250-300	300-350	From moderate hydrotreating of H-Coal syncrude feed (boiling range 140-704°F) from PDU Run 5 operated in syncrude mode, over ICR 106 catalyst for production of fuel oil (Chevron Run 76-171, Hours 1976-1991). Operating conditions: Catalyst temperature, 775°F; LHSV, 1.5; total pressure 2073 psig; hydrogen pressure 1859 psia	95
			API Gravity	61.6	51.8	45.9	39.9		
			TBP Distillation, °F†						
			ST/5	46/90	157/179	212/245	252/291		
			10/30	101/161	183/218	551/273	300/320		
			50	176	236	283	332		
			70/90	188/195	235/250	293/305	345/357		
			95/EP	198/208	256/269	311/321	362/367		
Coal-derived gasoline	NA	--			--			--	--

Explanatory Notes:

*Each period refers to a run time having a characteristic set of operating conditions.

†Distillation simulated by chromatography.

‡Determined by ASTM D-86.

Table 264. Elemental Composition of Various Distillation Fractions of Non-Primary Coal Naphthas and Gasoline

Material	Process	Coal Type		Value (Wt %)				Sample Description/Source	Reference
Coal raw naphtha	NA	--		--				--	--
			Boiling Range, C$_5$	Period 1*	Period 2*	Period 3*	Period 4*		
Naphtha from hydrotreated coal liquid	SRC-II	KY No. 9 and 14, IL No. 6 (King River Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	Nitrogen	0.00009	NA	NA	0.0002	Ft. Lewis pilot plant, 400°F+ SRC-II liquid hydrotreated with ICR 106 catalyst (Run No. 76-166). Operating conditions for Periods 1 through 4 respectively: time on-stream, hr., 145-169, 169-193, 313-337, 337-361; average catalyst temperature, °F, 746, 751, 752, 752; LHSV, 0.55, 0.43, 0.99 and 0.99.	86
			Oxygen	0.0110	NA	NA	0.0280		
			Boiling Range, °F	C$_5$-180	180-250	250-300	300-350		
	H-Coal	IL No. 6	Sulfur	NA	0.00002†	0.00003†	0.00005†	From hydrotreating of H-Coal syncrude feed (boiling range 140-704°F) from PDU Run 5 operated in syncrude mode, over fresh ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-171, Hours 222-246). Operating conditions: catalyst temperature, 750°F; LHSV, 1.0	95
			Boiling Range, °F	C$_5$-180	180-250				
		IL No. 6	Sulfur	NA	0.000014			From hydrotreating of rerun H-Coal syncrude feed from PDU Run 5 operated in syncrude mode over fresh ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-173, Hours 463-475). Operating conditions: catalyst temperature, 748°F; LHSV, 1.5.	95
			Boiling Range, °F	C$_5$-180	180-250	250-300	300-350		
		Wyodak	Sulfur	NA	0.000025	NA	NA	From hydrotreating of H-Coal syncrude feed (boiling range 120-650°F) from PDU Run 6 operated in syncrude mode, over fresh ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-173, Hours 331-355). Operating conditions: catalyst temperature, 752°F; LHSV, 1.0.	95

(Continued)

Table 264 (Continued)

Material	Process	Coal Type		Value (Wt %)				Sample Description/Source	Reference
			Boiling Range, °F	C_5-180	180-250				
Naphtha from hydrotreated coal liquid	H-Coal	IL No. 6	Sulfur	NA	0.000022			From hydrotreating of H-Coal syncrude feed (boiling range 140-704°F) from PDU Run 5 operated in syncrude mode, over aged ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-171, Hours 3191-3215). Operating conditions: catalyst temperature, 774°F; LHSV, 0.5.	95
			Boiling Range, °F	C_5-180	180-250				
		IL No. 6	Sulfur	NA	0.000020			From hydrotreating of rerun H-Coal syncrude feed from PDU Run 5 operated in syncrude mode, over aged ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-174, Hours 76-174). Operating conditions: catalyst temperature, 802°F; LHSV, 1.5.	95
			Boiling Range, °F	C_5-180	180-250				
		Wyodak	Sulfur	NA	0.000021			From hydrotreating of H-Coal syncrude feed (boiling range 120-650°F) from PDU Run 6 operated in syncrude mode, over aged ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-174, Hours 208-232). Operating conditions: catalyst temperature, 802°F; LHSV, 1.0.	95
			Boiling Range, °F	C_5-180	180-250	250-300	300-350		
		Wyodak	Sulfur	NA	0.00005	0.000071	0.000051	From hydrotreating of rerun H-Coal syncrude feed from PDU Run 6 operated in syncrude mode, over aged ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-174, Hours 604-610). Operating conditions: catalyst temperature, 803°F; LHSV, 1.5.	95

(Continued)

Table 264 (Concluded)

Material	Process	Coal Type	Boiling Range, °F	Value (Wt %) C_5-180	180-250	250-300	300-350	Sample Description/Source	Reference
Naphtha from hydro-treated coal liquid	H-Coal	IL No. 6	Sulfur	NA	0.000018	0.000026	0.000047	From moderate hydrotreating of H-Coal syncrude feed (boiling range 140-704°F) from PDU Run 5 operated in syncrude mode, over ICR 106 catalyst for production of heating oil (Chevron Run 76-171, Hours 1967-1991). Operating conditions: catalyst temperature, 775°F; LHSV, 1.5.	95
		IL No. 6	Sulfur Oxygen	NA NA	0.000028 <0.0050	0.00021 0.0060	0.000060 0.0210	From moderate hydrotreating of H-Coal syncrude feed (boiling range 140-704°F from PDU Run 5 operated in syncrude mode, over aged ICR 106 catalyst for production of fuel oil (Chevron Run 76-171, Hours 654-678). Operating conditions: catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2493 psig; hydrogen pressure, 2231 psia.	95
		IL No. 6	Sulfur Oxygen	NA NA	0.0003 0.0160	0.00033 NA	NA NA	From moderate hydrotreating of H-Coal syncrude feed (boiling range 140-704°F) from PDU Run 5 operated in syncrude mode, over ICR 106 catalyst for production of fuel oil (Chevron Run 76-171, Hours 1535-1559). Operating conditions: catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2001 psig; hydrogen pressure, 1778 psia.	95
		IL No. 6	Sulfur Oxygen	NA NA	0.000018 NA	0.000026 NA	0.000047 NA	From moderate hydrotreating of H-Coal syncrude feed (boiling range 140-704°F) from PDU Run 5 operated in syncrude mode, over ICR 106 catalyst for production of fuel oil (Chevron Run 76-171, Hours 1976-1991). Operating conditions: catalyst temperature, 775°F; LHSV, 1.5; total pressure, 2075 psig; hydrogen pressure, 1859 psia.	95

Explanatory Notes:

[a] Each period refers to a run time having a characteristic set of operating conditions.

[†] Measured at other hours but at these conditions.

Table 265. Hydrocarbon Class Analysis of Various Distillation Fractions of Non-Primary Coal Naphthas and Gasoline

Material	Process	Coal Type		Value (Vol %)				Sample Description/Source	Reference
			Boiling Range, C5-180°F	Period 1*	Period 2*	Period 3*	Period 4*		
Coal raw naptha	NA	--		--				--	--
Naphtha from hydrotreated coal liquid	SRC-II	KY No. 9 and 14, IL No. 6 (King River Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	Saturates† Aromatics	97.6 2.4	98.0 2.0	NA NA	82.9 17.1	Ft. Lewis pilot plant, 400°F+ SRC-II liquid hydrotreated with ICR 106 catalyst (Run No. 76-166). Operating conditions for periods 1 through 4 respectively: time on-stream, hr., 145-169, 169-193, 313-337, 337-361; average catalyst temperature, °F, 746, 751, 752, 752; LHSV, 0.55, 0.43, 0.99 and 0.99.	86
			Saturates‡ Aromatics	97.0 3.0	NA NA	87.3 12.7	NA NA		
			Boiling Range, °F	C_5-180	180-250	250-300	300-350		
	H-Coal	IL No. 6	Saturates Aromatics	98.0 2.0	98.1 1.9	98.2 1.8	98.3 1.7	From hydrotreating of H-Coal syncrude feed (boiling range 140-704°F) from PDU Run 5 operated in syncrude mode, over fresh ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-171, Hours 222-246). Operating conditions: catalyst temperature, 750°F; LHSV, 1.0	95
		IL No. 6	Saturates Aromatics	NA NA	98.4 1.6	NA NA	NA NA	From hydrotreating of rerun H-Coal syncrude feed from PDU Run 5 operated in syncrude mode over fresh ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-173, Hours 463-475). Operating conditions: catalyst temperature, 748°F; LHSV, 1.5.	95
		Wyodak	Saturates Aromatics	98.4 1.6	98.1 1.8	98.0 2.0	97.2 2.8	From hydrotreating of H-Coal syncrude feed (boiling range 120-650°F) from PDU Run 6 operated in syncrude mode, over fresh ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-173, Hours 331-355). Operating conditions: catalyst temperature, 752°F; LHSV, 1.0.	95

(Continued)

Table 265 (Continued)

Material	Process	Coal Type		Value (Vol %)				Sample Description/Source	Reference
			Boiling Range, °F	C_5-180	180-250	250-300	300-350		
Naphtha from hydro-treated coal liquid	H-Coal	IL No. 6	Saturates	94.5	93.6	NA	NA	From hydrotreating of H-Coal syncrude feed (boiling range 140-704°F) from PDU Run 5 operated in syncrude mode, over aged ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-171, Hours 3191-3215). Operating conditions: catalyst temperature, 774°F; LHSV, 0.5.	95
			Aromatics	5.5	6.4	NA	NA		
		IL No. 6	Saturates	NA	95.8	NA	NA	From hydrotreating of rerun H-Coal syncrude feed from PDU Run 5 operated in syncrude mode, over aged ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-174, Hours 76-174). Operating conditions: catalyst temperature, 802°F; LHSV, 1.5.	95
			Aromatics	NA	4.2	NA	NA		
		Wyodak	Saturates	NA	93.8	NA	NA	From hydrotreating of H-Coal syncrude feed (boiling range 120-650°F) from PDU Run 6 operated in syncrude mode, over aged ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-174, Hours 208-232). Operating conditions: catalyst temperature, 802°F; LHSV, 1.0.	95
			Aromatics	NA	6.2	NA	NA		
		Wyodak	Saturates	97.4	95.8	92.9	93.0	From hydrotreating of rerun H-Coal syncrude feed from PDU Run 6 operated in syncrude mode, over aged ICR 106 catalyst for production of jet/diesel fuel (Chevron Run 76-174, Hours 604-610). Operating conditions: catalyst temperature, 803°F; LHSV, 1.5.	95
			Aromatics	2.6	4.2	7.1	7.0		

(Continued)

Table 265 (Continued)

Material	Process	Coal Type	Boiling Range, °F	Value (Vol %) C_5-180	180-250	250-300	300-350	Sample Description/Source	Reference
Naphtha from hydro-treated coal liquid	H-Coal	IL No. 6	Saturates	93.9	86.9	75.9	73.8	From moderate hydrotreating of H-Coal syncrude feed (boiling range 140-704°F) from PDU Run 5 operated in syncrude mode, over ICR 106 catalyst for production of heating oil (Chevron Run 76-171, Hours 1967-1991). Operating conditions: catalyst temperature, 775°F; LHSV, 1.5.	95
			Aromatics	6.1	13.1	24.1	26.2		
		Wyodak	Saturates	NA	90.7	NA	NA	From moderate hydrotreating of H-Coal syncrude feed (boiling range 120-650°F) from PDU Run 6 operated in syncrude mode, over ICR 113 catalyst for production of heating oil (Chevron Run 66-203, Hours 1366-1390). Operating conditions: catalyst temperature, 747°F; LHSV, 1.5.	95
			Aromatics	NA	9.2	NA	NA		
		IL No. 6	Saturates	92.5	87.9	77.4	75.0	From moderate hydrotreating of H-Coal syncrude feed (boiling range 140-704°F) from PDU Run 5 operated in syncrude mode, over ICR 106 catalyst for production of fuel oil (Chevron Run 76-171, Hours 654-678). Operating conditions: catalyst temperature, 750°F; LHSV, 1.5; total pressure, 2493 psig; hydrogen pressure, 2231 psia.	95
			Aromatics	7.5	12.1	22.6	25.0		
		IL No. 6	Saturates	93.6	86.8	80.5	73.9	From moderate hydrotreating of H-Coal syncrude feed (boiling range 140-704°F) from PDU Run 5 operated in syncrude mode, over ICR 106 catalyst for production of fuel oil (Chevron Run 76-171, Hours 1535-1559). Operating conditions: catalyst temperature 750°F; LHSV, 1.5; total pressure 2001 psig; hydrogen pressure 1778 psia.	95
			Aromatics	6.2	13.1	19.5	26.1		

(Continued)

Table 265 (Concluded)

Material	Process	Coal Type		Value (Vol %)				Sample Description/Source	Reference
			Boiling Range, °F	C_5-180	180-250	250-300	300-350		
Naphtha from hydro-treated coal liquid	H-Coal	IL No. 6	Saturates	93.9	86.9	75.9	73.8	From moderate hydrotreating of H-Coal syncrude feed (boiling range 140-704°F) from PDU Run 5 operated in syncrude mode, over ICR 106 catalyst for production of fuel oil (Chevron Run 76-171, Hours 1976-1991). Operating conditions: catalyst temperature, 775°F; LHSV, 1.5; total pressure, 2075 psig; hydrogen pressure, 1859 psia.	95
			Aromatics	6.1	13.1	24.1	26.2		

Explanatory Notes:

*Each period refers to a run time having a characteristic set of operating conditions.

†By Low Resolution Mass Spectroscopy.

‡By Chromatography

Explanatory Notes

1. Operating data are reported when available from the reference cited or from other readily available sources.

2. Data cited from Reference 83 from SRC-I Ft. Lewis pilot plant runs with Kentucky Nos. 9 and 14 coals are typical values obtained under the wide range of operating conditions summarized below:

Run	Material Balance Runs	Production Run	Laboratory Merriam, Ka.
Feed Slurry Coal Conc. (wt%)	35-40	35-40	35-50
Total Space Rate (lb/hr/ft^3	29-98.8		68-203
Reactor Temperature (°F)	844-870	840-860	816-869
Reactor Pressure (psig)	1027-1528		1410-2000
Gas Feed Rate, Thousands (SCF/T)	14.0-21.3		17.2-57.2
Total Coal Conversion		93-94	93-96
H_2 Consumption (% MAF Feed Coal)	1.9-3.6		1.4-3.5
SRC Yield (% MAF Feed Coal	58.3-67.3		33.7-63.5
Gas Yield (%)	4.9-8.7		5.7-20.4
Liquid Yield (%)	6.6-17.7		9.5-24.8
Sulfur in SRC (%)	0.76 (avg)	0.56-0.92	0.36-0.84

3. Data cited for Reference 97 for H-coal naphtha derived from PDU atmospheric and vacuum still overhead streams are for the following operating conditions: 2.245 psig at the reactor outlet and 850°F reactor temperatures. In the fuel oil mode of operation, a coal feed rate of 62.4 lbs/hr/ft^3 reactor

(Continued)

with hot separator reactor slurry recycle of 1.045 lbs/lb coal and a distillate recycle of 1.40 lbs/lb coal yielded a feed slurry containing 29.03 weight-percent coal. The blend of material produced by the reactor opertion consisted of 27.9 weight-percent overhead produce (distillate) and 72.1 weight-percent vacuum bottoms product. In the syncrude mode of operation, a coal feed rate of 31.2 lbs/hr/ft^3 reactor with a hot separator reactor slurry recycle of 3.98 lbs/lb coal and a distillate recycle of 0.40 lbs/lb coal yielded a feed slurry containing 20.08 weight-percent coal. The blend of material produced by the reactor in the syncrude mode of operation consisted of 48.2 weight-percent overhead product and 51.8 weight-percent vacuum bottoms product. The amount of reacted hydrogen in the fuel oil and the syncrude mode of operation were determined to be 12.2 and 15.2 Mscf/ton coal, respectively. The catalyst used in both processes was American Cyanamid HDS-2A.

4. Data cited in Reference 85 for bench-scale continuous platforming of hydrotreated coal naphtha Sample No. 3777-2 (UOP Research Plant 636, Run 335) were obtained under the following operating conditions:

Period	P-P(base), psi	T-T(base),°C	LHSV/LHSV base
1	0	-121	1.52
2	0	-87	1.48
3	0	-60	1.50
4	0	-105	1.50
5	0	-87	1.46

5. Data cited in Reference 87 for bench-scale continuous platforming of moderately hydrotreated coal naphtha Sample No. 3531-12 (UOP Research Plant 508, Run 1456) were obtained under the following operating conditions:

Period	P-P(base), psi	T-T(base),°C	LHSV/LHSV base
1	0	-53	1.55
2	0	-73	1.52
3	0	-86	1.53
4	0	-97	1.52
5	0	-114	1.52
6	0	-119	1.42
7	0	-120	1.52
8	0	-69	1.51
9	0	-39	1.53
10	0	-6	1.51

(Continued)

6. Data cited in Reference 92 for bench-scale continuous platforming of moderately hydrotreated coal naphtha Sample No. 3531-4 (UOP Research Plant 636, Run 220) were obtained under the following operating conditons:

Period	P-P(base), psi	T-T(base),°C	LHSV/LHSV base
1	0	-52	1.43
2	0	-52	1.49
4	0	-59	1.48
5	0	-66	1.51
6	0	-66	1.53
7	0	-78	1.49
8	0	-78	1.45
10	0	-88	1.49
14	0	-18	1.50

7. Data cited for Reference 86 for Chevron coal raw naphtha Sample No. WOW 3750 hydrotreated with ICR 113 catalyst (Run No. 65-194, Run Hours 111-135 and 231-255) respectively, were obtained under the following operating conditions:

Run Hours	111-135	231-255
Avg. Catalyst Temp; °F	692	699
LHSV	1.03	0.95
Total Pressure, psig	799	793
H_2 Mean Pressure, psia	642	645
Total Gas In, SCF/.Bbl	4391	4629
Recycle Gas, SCP/Bbl	3282	3449

8. Data cited for Reference 86 for Chevron coal raw naphtha Sample No. SGQ 6502 partially hydrotreated and hydrofined with ICR 113 catalyst (Run No. 72-326, Run Hours 138-150 and 222-246) respectively, were obtained under the following operating conditions:

Run Hours	138-150	222-246
Avg. Catalyst Temp; *F	700	70
LHSV	2.02	2.01
Total Pressure, psig	648	638
H_2 Mean Pressure, psia	523	505
Total Gas In, SCF/Bbl	3029	2824
Recycle Gas, SCF/Bbl	2941	2695

9. The following additional motor octane values are available for H-Coal naphtha derived from the PDU operated in the syncrude mode: 82.9 (IL. No. 6 coal), 65.2 (Wyodak coal), and 73.3 (W. KY No. 11 coal) (Reference 109).

General Comments

10. The following saturates and aromatics were identified in H-Coal naphtha derived from IL No. 6 Coal, (PDU, syncrude mode) (Ref. 109):

A. Saturates

C_5 Alkane
Cyclopentane
C_6 Alkane
Methylcyclopentane
C_6 Alkane
Cyclohexane
Dimethylcyclopentane
Methylcyclohexane
Dimethylcyclohexane
Alkane
C_9 Cycloalkane
trans-Hydrindane
cis-Hydrindane
Methyl-trans-Hydrindane
Methyl-cis-Hydrindane
Trans-Decalin
Indane
cis-Decalin
2-Methylindane
1-Methylindane
C_{11} aromatic
5-Methylindane
4-Methylindane
Tetralin
2-Methyltetralin

B. Aromatics

Benzene
Toluene
Ethylbenzene
m&p-Xylenes
o-Xylene
C_9 Aromatic
C_{10} Aromatic
Naphthalene

11. A value of 0.2 ppm benzopyrene was determined in SRC-I naphtha obtained from the Ft. Lewis pilot plant (Reference 146).

Table 267. API Gravity

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	10.0†	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	8.1†	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	14.7†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	13.3†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	SRC-II	NA	13.3	Ft. Lewis pilot plant	84
		Pittsburgh No. 8 (Powhattan Mine)	13.4	Ft. Lewis pilot plant	101
	EDS	IL No. 6	17.7	Raw 350-650°F distillate from one tpd pilot plant	99
	H-Coal	IL No. 6	15.4	380-650°F distillate from PDU, Run 5, Run 130-82, Period 29‡	111
		Wyodak	21.4	380-650°F distillate from PDU Run 6, Run 130-83, Period 17§	112
		NA	18.4	>450-650°F distillate from PDU (EPRI Sample No. 3)	84
		IL No. 6	17.5	400-650°F distillate from PDU, syncrude mode	98

(Continued)

Table 267 (Continued)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	IL No. 6 (Burning Star Mine)	13.0	Derived from PDU atmospheric still overhead and vacuum still overhead streams, fuel oil mode (analyzed by BETC)#	97
		IL No. 6 (Monterey Mine)	6.6	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)#	97
		IL No. 6 (Burning Star Mine)	16.7	PDU (Ashland Oil sample)	96
		NA	29.5	260-552°F distillate derived from atmospheric still overhead streams	108
		IL No. 6	15.1	PDU, syncrude mode	109
		Wyodak	22.7	PDU, syncrude mode	109
		W. KY No. 11	14.6	PDU, syncrude mode	109
		IL No. 6	∿37	250-600°F distillate, PDU, syncrude mode	95
		Wyodak	38.0	250-600°F distillate, PDU, syncrude mode	95
Coal raw middle distillate blends (light fuel oils)	SRC-II	NA	14.2	5.75/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		Pittsburgh No. 8 (Powhattan Mine)	10.4	2.9/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		NA	11.7	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant	84
		NA	10.3	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant	108

(Continued)

Table 267 (Continued)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw middle distillate blends (light fuel oils)	SRC-11	NA	9.7	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-6	113
		NA	10.1	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-7	113
		NA	11	Medium and heavy distillate blend	114
		NA	11.0 (60°F)	5.75/1 medium/heavy distillate blend	121
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	SRC-11	Pitt-Seams WV (Blackville No. 2 Mine)	36.3	Single-stage hydrotreated <554°F distillate**	88
	EDS	IL No. 6 (Monterey Mine)	30	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	104
		IL No. 6	14.7	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	18.0	From low severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	19.0	From moderate severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99

(Continued)

Table 267 (Continued)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Hydrotreated middle distillates (jet/diesel/ other light fuel oil)	EDS	IL No. 6	30.4	From high severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		Wyodak	35.2	Raffinate from continuous extraction (4:1 sulfolane: feed) of 350-525°F hydrotreated solvent from one tpd pilot plant	99
	H-Coal	IL No. 6 (Burning Star Mine)	37	Single-stage hydrotreated <554°F distillate from PDU††	88
		Wyodak	39.7	Single-stage hydrotreated <554°F distillate from PDU††	88
Hydrotreated middle distillate blends (light fuel oils)	SRC-II	NA	17.0	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-21	113
		NA	13.6	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, 400°F$^+$ liquid product, UOP Sample No. 3777-34	113
		NA	23.4	Severely hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-28	113

(Continued)

Table 267 (Concluded)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Hydrotreated middle distillate blends (light fuel oils)	SRC-II	NA	17.7	Severely hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-41	113

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via ASTM D-1298; measured at 60°F.

‡See General Comments section, Note 4, for summary of operating conditions used.

§See General Comments section, Note 5, for summary of operating conditions used.

#See General Comments section, Note 3, for summary of operating conditions used.

**See General Comments section, Note 6, for summary of operating conditions used.

††See General Comments section, Note 7, for summary of operating conditions used.

Table 268. Density

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw middle distillates	NA	--	--	--	--
Coal raw middle distillate blends (light fuel oil)	SRC-II	NA	0.9951	Medium and heavy distillate blend, before water wash, Chevron Sample No. SGQ-7559	115
		NA	0.9885	Medium and heavy distillate blend, after water wash, Chevron Sample No. WOW-4551	115
Hydro-treated middle distillates (jet/diesel/other light fuel oil)	NA	--	--	--	--
Hydro-treated middle distillate blends (light fuel oils)	NA	--	--	--	--

Table 269. Reid Vapor Pressure

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	0.0†	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	0.0†	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	0.0†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	0.0†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
Coal raw middle distillate blends (light fuel oil)	NA	--	--	--	--
Hydro-treated middle distillates (jet/diesel/other light fuel oil)	NA	--	--	--	--
Hydro-treated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via ASTM D-323.

Table 270. Distillation Data

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I[*]	KY No. 9	418°F-IBP[†] 452°F-10 NA-15 470°F-20 488°F-30 512°F-40 528°F-50 545°F-60 568°F-70 596°F-80 600°F-90 NA-EP	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	412°F-IBP[†] 436°F-10 NA-15 452°F-20 470°F-30 487°F-40 502°F-50 528°F-60 550°F-70 578°F-80 600°F-90 606°F-EP	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	412°F-IBP[†] 472°F-10 NA-15 487°F-20 496°F-30 541°F-40 546°F-50 570°F-60 584°F-70 596°F-80 605°F-90 618°F-EP	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC, Finer-29, APCI Sample No. 1941CB-1)	82

(Continued)

Table 270 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-1[*]	KY No. 9	416°F-IBP[†] 438°F-10 NA-15 454°F-20 484°F-30 526°F-40 548°F-50 558°F-60 568°F-70 578°F-80 600°F-90 610°F-EP	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	SRC-II	NA	210°F-IBP[†] NA-5 396°F-10 420°F-30 444°F-50 470°F-70 509°F-90 530°F-95 546°F-EP	Ft. Lewis pilot plant	84
		Pittsburgh No. 8 (Powhattan Mine)	220°F-IBP[†] 390°F-10 408°F-20 414°F-30 424°F-40 434°F-50 446°F-60 448°F-70 464°F-80 490°F-90 516°F-EP	Ft. Lewis pilot plant	101
	H-Coal	NA	352°F-IBP[†] 402°F-5 418°F-10 444°F-30 458°F-50 508°F-70 576°F-90 616°F-95 685°F-EP	450-650°F distillate from PDU	84

(Continued)

Part IX. Raw and Hydrotreated Middle Distillates and Blends (Jet, Diesel, Other Light Fuel Oils)

Table 266. Specific Gravity

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	1.000[†]	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	1.0136[†]	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	0.9679[†]	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	0.9772[†]	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	SRC-II	NA	0.97 (60°F)	Ft. Lewis pilot plant	102
		NA	0.9796 (60.8°F)	Ft. Lewis pilot plant	122
	H-Coal	IL No. 6 (Burning Star Mine)	0.979	Derived from PDU atmospheric still overhead and vacuum still overhead streams, fuel oil mode (analyzed by BETC)[‡]	97
		IL No. 6 (Monterey Mine)	1.025	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)[‡]	97
Coal raw middle distillate blends (light fuel oils)	SRC-II	NA	1.0021	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-6	113
		NA	0.9993	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-7	113

(Continued)

Table 266 (Concluded)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Hydrotreated middle distillates (jet/diesel/ other fuel oil)	NA	--	--	--	--
Hydrotreated middle distillate blends (light fuel oils)	SRC-II	NA	0.9529	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-21	113
		NA	0.9752	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, 400°F+ liquid product, UOP Sample No. 3777-34	113
		NA	0.9135	Generally hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-28	113
		NA	0.9484	Generally hydrotreated 2.9/1 medium/heavy distillate blend, 400°F+ liquid product, UOP Sample No. 3777-41	113

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively. The calculated specific gravity of this blend is approximately 0.998 (Reference 100).

†Determined via ASTM D-1298

‡See General Comments section, Note 3, for summary of operating conditions used.

Table 270 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	IL No. 6 (Burning Star Mine)	452°F-IBP 452°F-5 452°F-10 454°F-20 470°F-30 492°F-40 514°F-50 534°F-60 570°F-70 592°F-80 616°F-90 630°F-95 636°F-EP	PDU (Ashland Oil Sample)	96
		IL No. 6	398°F-IBP 423°F-5 438°F-10 455°F-20 467°F-30 482°F-40 500°F-50 522°F-60 548°F-70 570°F-80 605°F-90 620°F-95 634°F-EP[†,#]	380-650°F distillate from PDU Run 5, Run 130-82, Period 29[**]	111
		Wyodak	396°F-IBP 418°F-5 426°F-10 435°F-20 446°F-30 455°F-40 474°F-50 496°F-60 530°F-70 575°F-80 608°F-90 625°F-95 640°F-EP	380-650°F distillate from PDU Run 6, Run 130-83, Period 17[††]	112

(Continued)

Table 270 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw middle distillate blends (light fuel oils)	SRC-II	NA	226°F-IBP[†] 384°F-10 398°F-20 410°F-30 428°F-40 448°F-50 460°F-60 486°F-70 518°F-80 566°F-90 604°F-EP	5.75/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		Pittsburgh No. 8 (Powhattan Mine)	230°F-IBP[†] 386°F-10 408°F-20 424°F-30 428°F-40 448°F-50 478°F-60 498°F-70 536°F-80 618°F-90 658°F-EP	2.9/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		NA	220°F-IBP[†] 382°F-5 404°F-10 433°F-30 459°F-50 491°F-70 578°F-90 640°F-95 640°F-EP	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant	84
		NA	386/407°F-IBP[§] 417/445°F-10/30 486°F-50 535/645°F-70/90 711/799°F-95/EP	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-6	113

(Continued)

Table 270 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw middle distillate blends (light fuel oils)	SRC-II	NA	325/395°F-IBP[§] 410/444°F-10/30 472°F-50 512/656°F-70/90 705/810°F-95/EP	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-7	113
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	EDS	IL No. 6	376°F-10 431°F-50 560°F-90	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	341°F-10 411°F-50 552°F-90	From low severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	328°F-10 408°F-50 547°F-90	From moderate severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	316°F-10 386°F-50 509°F-90	From high severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		Wyodak	392°F-IBP 514°F-EP[#]	Raffinate from continuous extraction (4:1 sulfolane: feed) of 350-525°F hydrotreated solvent from one tpd pilot plant	99

(Continued)

Table 270 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Hydrotreated middle distillate blends (light fuel oils)	SRC-II	NA	280/350°F-IBP§ 374/422°F-10/30 460°F-50 505/611°F-70/90 687/779°F-95/EP	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-21	113
		NA	418/428°F-IBP§ 436/462°F-10/30 487°F-50 539/641°F-70/90 691/790°F-95/EP	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, 400°F$^+$ liquid product, UOP Sample No. 3777-34	113
		NA	234/302°F-IBP§ 331/400°F-10/30 446°F-50 490/575°F-70/90 628/724°F-95/EP	Severely hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-28	113
		NA	408/440°F-IBP§ 448/463°F-10/30 490°F-50 536/625°F-70/90 668/748°F-95/EP	Severely hydrotreated 2.9/1 medium/heavy distillate blend, 400°F$^+$ liquid product, UOP Sample No. 3777-41	113

(Continued)

Table 270 (Concluded)

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via ASTM D-86.

‡98% recovery.

§Determined via ASTM D-1160.

#1.0% residue, 1.0% loss.

**See General Comments section, Note 4, for summary of operating conditions used.

††See General Comments section, Note 5, for summary of operating conditions used.

Table 271. GC Simulated Distillation Data

Material	Process	Coal Type	Boiling Point Range	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	385°F-IBP† 424°F-10 441°F-15 453°F-20 482°F-30 508°F-40 534°F-50 557°F-60 584°F-70 604°F-80 628°F-90 741°F-EP	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	384°F-IBP† 415°F-10 NA-15 445°F-20 464°F-30 488°F-40 515°F-50 538°F-60 561°F-70 594°F-80 612°F-90 699°F-EP	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	393°F-IBP† 447°F-10 471°F-15 492°F-20 525°F-30 544°F-40 566°F-50 585°F-60 601°F-70 617°F-80 634°F-90 661°F-EP	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82

(Continued)

Table 271 (Continued)

Material	Process	Coal Type	Boiling Point Range	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	397°F-IBP† 443°F-10 482°F-15 511°F-20 533°F-30 549°F-40 568°F-50 588°F-60 606°F-70 627°F-80 674°F-90 NA-EP	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
		KY No. 9	406°F-IBP† 446°F-10 455°F-15 467°F-20 488°F-30 509°F-40 528°F-50 547°F-60 572°F-70 598°F-80 613°F-90 676°F-EP	Wilsonville pilot plant, Alcoa coker unit, (APCI Sample No. 1899CB)	82
	SRC-II	NA	279°F-IBP† 331°F-5 355°F-10 399°F-30 439°F-50 472°F-70 514°F-90 535°F-95 584°F-EP	Ft. Lewis pilot plant	84
	H-Coal	NA	295°F-IBP† 367°F-5 389°F-10 426°F-30 458°F-50 500°F-70 558°F-90 586°F-95 685°F-EP	450-650°F distillate from PDU	84

(Continued)

Table 271 (Continued)

Material	Process	Coal Type	Boiling Point Range	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	IL No. 6	408°F-IBP[†]	PDU, syncrude mode	109
			435°F-5		
			443°F-10		
			459°F-20		
			477°F-30		
			492°F-40		
			509°F-50		
			525°F-60		
			540°F-70		
			558°F-80		
			583°F-90		
			598°F-95		
			657°F-EP		
		Wyodak	365°F-IBP[†]	PDU, syncrude mode	109
			400°F-5		
			415°F-10		
			435°F-20		
			447°F-30		
			456°F-40		
			469°F-50		
			485°F-60		
			497°F-70		
			516°F-80		
			543°F-90		
			567°F-95		
			602°F-EP		
		W. KY No. 11	392°F-IBP[†]	PDU, syncrude mode	109
			406°F-5		
			420°F-10		
			447°F-20		
			470°F-30		
			495°F-40		
			520°F-50		
			546°F-60		
			570°F-70		
			594°F-80		
			624°F-90		
			648°F-95		
			703°F-EP		

(Continued)

Table 271 (Concluded)

Material	Process	Coal Type	Boiling Point Range	Sample Description/Source	Reference
Coal raw middle distillate blends (light fuel oils)	SRC-II	NA	276°F-IBP[†] 331°F-5 358°F-10 404°F-30 445°F-50 482°F-70 540°F-90 593°F-95 762°F-EP	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant	84
		NA	284°F-IBP 468°F-average 739°F-EP	Medium and heavy distillate blend, before water wash, Chevron Sample No. SGQ-7559	115
		NA	297°F-IBP 469°F-average 754°F-EP	Medium and heavy distillate blend, after water wash, Chevron Sample No. WOW-4551	115
Hydrotreated middle distillates (jet/diesel, other light fuel oil)	NA	--	--	--	--

Explanatory Notes

[*] The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

[†] Determined via ASTM D-2887.

[‡] Determined by ASTM D-2887 modified by decreasing the distillation rate to prevent foaming.

Table 272. Refractive Index

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	IL No. 6	1.514 (68°F)	400-650°F distillate from PDU, syncrude mode	98
		IL No. 6	1.529 (68°F)	380-650°F distillate from PDU Run 5, Run 130-82 Period 29*	111
		Wyodak	1.5308 (68°F)	380-650°F distillate from PDU Run 6, Run 130-83 Period 17†	112
Coal raw middle distillate blends (light fuel oil)	NA	--	--	--	--
Hydro-treated middle distillates (jet/diesel/other light fuel oil)	NA	--	--	--	--
Hydro-treated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*See General Comments section, Note 4, for summary of operating conditions used.

†See General Comments Section, Note 5, for summary of operating conditions used.

Table 273. Molecular Weight

Material	Process	Coal Type	Value (g/mole)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	160†	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	130†	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	205†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	190†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	H-Coal	IL No. 6	186	PDU, syncrude mode	109
		Wyodak	177	PDU, syncrude mode	109
		W. KY No. 11	175	PDU, syncrude mode	109
Coal raw middle distillate blends (light fuel oils)	NA	--	--	--	--
Hydro-treated middle distillate blends (jet/diesel/ other light fuel oil)	NA	--	--	--	--

(Continued)

Table 273 (Concluded)

Material	Process	Coal Type	Value (g/mole)	Sample Description/Source	Reference
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via APCI method.

Table 274. Total Acid Number

Material	Process	Coal Type	Value (mg KOH/g)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	22.5†	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	19.43†	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	4.83†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	4.64†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
Coal raw middle distillate blends (light fuel oils)	NA	--	--	--	--
Hydrotreated middle distillate blends (jet/diesel/other light fuel oil)	NA	--	--	--	--
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via ASTM D-664.

Table 275. Gum Content

Material	Process	Coal Type	Value (mg/100 ml)	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	IL No. 6	1	250-600°F distillate, PDU, syncrude mode	95
		Wyodak	1	250-600°F distillate, PDU, syncrude mode	95
Coal raw middle distillate blends (light fuel oils)	--	--	--	--	--
Hydrotreated middle distillates blends (jet/diesel/other light fuel oil)	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	2	Single-stage hydrotreated <554°F distillate*	88
	EDS	Wyodak	3.2	Raffinate from continuous extraction (4:1 sulfolane: feed) of 350-525°F hydrotreated solvent from one tpd pilot plant	99
	H-Coal	IL No. 6 (Burning Star Mine)	1	Single-stage hydrotreated <554°F distillate from PDU†	88
		Wyodak	1	Single-stage hydrotreated 554°F distillate from PDU†	88
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*See General Comments section, Note 6, for summary of operating conditions used.

†See General Comments section, Note 7, for summary of operating conditions used.

Table 276. Viscosity

Material	Process	Coal Type	Value (Centistokes)	Sample Description/Source	Reference
Coal raw middle	SRC-I*	KY No. 9	13.445 (68°F)† 6.029 (104°F) 3.441 (140°F)	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	9.367 (68°F)† 4.715 (104°F) 2.851 (140°F)	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	8.46 (68°F)† 4.62 (104°F) 2.92 (140°F)	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	7.137 (68°F)† 3.998 (104°F) 2.581 (140°F)	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	SRC-II	NA	3.20 (104°F) 1.08 (212°F)	Ft. Lewis pilot plant	84
		Pittsburgh No. 8 (Powhattan Mine)	36.4 (SSU at 140°F) 31.8 (SSU at 210°F)	Ft. Lewis pilot plant	101
		NA	6.3 (60°F)	Ft. Lewis pilot plant	102
		NA	3.55×10^{-6} m^2/s (100.6°F)	Ft. Lewis pilot plant	122
	EDS	IL No. 6	0.7 (100°F)	Raw 350-650°F distillate from one tpd pilot plant	99
	H-Coal	IL No. 6	46 (SSU at 72°F)	380-650°F distillate from PDU Run 5, Run 130-82, Period 29‡	111
		NA	2.56 (104°F) 0.99 (212°F)	450-650°F distillate from PDU	84

(Continued)

Table 276 (Continued)

Material	Process	Coal Type	Value (Centistokes)	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	IL No. 6	4.1 (100°F) 2.4 (210°F)	400-650°F distillate from PDU, syncrude mode	98
		IL No. 6 (Burning Star Mine)	3.87 (100°F)† 39 (SSU at 100°F)	Derived from PDU atmospheric still overhead and vacuum still overhead streams, fuel oil mode (analyzed by BETC)§	97
		IL No. 6 (Monterey Mine)	14.90 (100°F)† 77 (SSU at 100°F)	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)§	97
		NA	1.17 (100°F)	260-552°F distillate derived from atmospheric still overhead streams	108
		IL No. 6	3.369 (104°F) 1.224 (212°F)	PDU, syncrude mode	109
		Wyodak	2.280 (104°F) 0.950 (212°F)	PDU, syncrude mode	109
		W. KY No. 11	3.516 (104°F) 1.067 (212°F)	PDU, syncrude mode	109
Coal raw middle distillate blends (light fuel oils)	SRC-II	NA	35.7 (SSU at 140°F) 32.6 (SSU at 210°F)	5.75/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		Pittsburgh No. 8 (Powhattan Mine)	36.8 (SSU at 140°F) 33.0 (SSU at 210°F)	2.9/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		NA	3.87 (104°F) 1.19 (212°F)	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant	84

(Continued)

Table 276 (Continued)

Material	Process	Coal Type	Value (Centistokes)	Sample Description/Source	Reference
Coal raw middle distillate blends (light fuel oils)	SRC-II	NA	4.42 (100°F)	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant	108
		NA	9.94	Medium and heavy distillate blend, before water wash, Chevron Sample No. SGQ-7559	115
		NA	9.39	Medium and heavy distillate blend, after water wash, Chevron Sample No. WOW-4551	115
		NA	40 (SSU at 100°F)	5.75/1 medium/heavy distillate blend	121
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	EDS	IL No. 6 (Monterey Mine)	32 (SSU at 100°F)	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	104
		IL No. 6	2.1 (100°F)	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	1.9 (100°F)	From low severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	1.9 (100°F)	From moderate severity hydrotreatment of 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	1.9 (100°F)	From high severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99

(Continued)

Table 276 (Concluded)

Material	Process	Coal Type	Value (Centistokes)	Sample Description/Source	Reference
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	EDS	Wyodak	5.5 (5°F)	Raffinate from continuous extraction (4:1 sulfolane:feed) of 350-525°F hydrotreated solvent from one tpd pilot plant	99
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via ASTM D-445.

‡See General Comments section, Note 4, for summary of operating conditions used.

§See General Comments section, Note 3, for summary of operating conditions used.

Table 277. Pour Point

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	9†	Wilsonville pilot plant, (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	-40†	Wilsonville pilot plant, (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	-42†	Derived from Lummus LC-Finer unit for the Wilsonville pilot plant (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB)	82
			-45†	Derived from Lummus LC-Finer unit for the Wilsonville pilot plant (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	SRC-II	NA	<-65	Ft. Lewis pilot plant	84
		NA	<-45	Ft. Lewis pilot plant	102
		NA	-0.4	Ft. Lewis pilot plant	122
	H-Coal	IL No. 6	-35	380-650°F distillate from PDU Run 5, Run 130-82, Period 29‡	111
		Wyodak	-10	380-650°F distillate from PDU Run 6, Run 130-83, Period 17‡	112
		NA	<-65.0	450-650°F distillate from PDU	84
		IL No. 6	-100	400-650°F distillate from PDU, syncrude mode	98

(Continued)

Table 277 (Continued)

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	IL No. 6 (Burning Star Mine)	<5	Derived from PDU atmospheric still overhead and vacuum still overhead streams, fuel oil mode (analyzed by BETC)§	97
		IL No. 6 (Monterey Mine)	<5	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)§	97
		NA	-65	260-552°F distillate derived from atmospheric still overhead streams	108
		IL No. 6	-35	PDU, syncrude mode	109
		Wyodak	-25	PDU, syncrude mode	109
		W. KY No. 11	-60	PDU, syncrude mode	109
Coal raw middle distillate blends (light fuel oils)	SRC-II	NA	<-65	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant	84
		NA	-60	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant	108
		NA	-30	5.75/1 medium/heavy distillate blend	121
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	EDS	IL No. 6 (Monterey Mine)	-70	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	104

(Continued)

Table 277 (Concluded)

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via ASTM D-97.

‡See General Comments section, Note 4, for summary of operating conditions used.

§See General Comments section, Note 3, for summary of operating conditions used.

Table 278. Carbon Residue

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I[*]	KY No. 9	0.01[†]	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1879CB)	82
		KY No. 9	0.03[†]	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	0.00[†]	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	0.00[†]	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	SRC-II	NA	0.17[‡]	Ft. Lewis pilot plant	84
		NA	0.03[‡]	Ft. Lewis pilot plant	102
	EDS	IL No. 6	0.2[‡]	Raw 350-650°F distillate from one tpd pilot plant	99
	H-Coal	NA	0.08[‡]	450-650°F distillate from PDU	84
Coal raw middle distillate blends (fuel oils)	SRC-II	NA	0.36[‡]	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant	84
		NA	0.51	Medium and heavy distillate blend	114
Hydrotreated middle distillate (jet/diesel/other light fuel oil)	EDS	IL No. 6 (Monterey Mine)	0.01[‡]	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	104
		IL No. 6	0.4[‡]	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	99

(Continued)

Table 278 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated middle distillates (jet/diesel/ other light fuel oil)	EDS	IL No. 6	0.05‡	From low severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	0.04‡	From moderate severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	0.01‡	From high severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via ASTM D-189.

‡Conradson carbon residue.

Table 279. Bottom Sediment and Water

Material	Process	Coal Type	Value (ml)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	$<0.05^{\dagger}$	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	$<0.05^{\dagger}$	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	$<0.05^{\dagger}$	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	$<0.05^{\dagger}$	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	SRC-II	NA	0.10 (wt %)	Ft. Lewis pilot plant	101
Coal raw middle distillate blends (light fuel oil)	SRC-11	NA	0.04	5.75/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		Pittsburgh No. 8 (Powhattan Mine)	0.04	2.9/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	NA	--	--	--	--

(Continued)

Table 279 (Concluded)

Material	Process	Coal Type	Value (ml)	Sample Description/Source	Reference
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via ASTM D-1796.

Table 280. Freeze Point

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	-25†	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	-50†	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	<-76†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	<-76†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	H-Coal	Wyodak	-61	250-600°F distillate, PDU, syncrude mode	95
Coal raw middle distillate blends (light fuel oils)	NA	--	--	--	--
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	-75	Single-stage hydrotreated <554°F distillate‡	88
	EDS	Wyodak	-47.2	Raffinate from continuous extraction (4:1 sulfolane: feed) of 350-525°F hydrotreated solvent from one tpd pilot plant	99
	H-Coal	IL No. 6	-53	Single-stage hydrotreated <554°F distillate from PDU§	88

(Continued)

Table 280 (Concluded)

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	H-Coal	Wyodak	<-40	Single-stage hydrotreated <554°F distillate from PDU§	88
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via ASTM D-2386.

‡See General Comments section, Note 6, for summary of operating conditions used.

§See General Comments section, Note 7, for summary of operating conditions used.

Table 281. Flash Point

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	206†	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	215†	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	230†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	222†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	SRC-II	NA	169	Ft. Lewis pilot plant	84
		Pittsburgh No. 8 (Powhattan Mine)	147	Ft. Lewis pilot plant	101
		NA	>160	Ft. Lewis pilot plant	102
	EDS	IL No. 6	158	Raw 350-650°F distillate from one tpd pilot plant	99
	H-Coal	IL No. 6	205	380-650°F distillate from PDU Run 5, Run 130-82, Period 29‡	111
		NA	145.0	450-650°F distillate from PDU	84
		NA	110	260-552°F distillate derived from atmospheric still overhead streams	108

(Continued)

Table 281 (Continued)

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	IL No. 6	225	PDU, syncrude mode	109
		Wyodak	190	PDU, syncrude mode	109
		W. KY No. 11	214	PDU, syncrude mode	109
Coal raw middle distillate blends (light fuel oil)	SRC-II	NA	160	5.75/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		Pittsburgh No. 8 (Powhattan Mine)	150	2.9/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		NA	168	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant	84
		NA	170	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant	108
		NA	150	5.75/1 medium/heavy distillate blend	121
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	>100	Single-stage hydrotreated <554°F distillate[§]	88
	EDS	IL No. 6 (Monterey Mine)	120	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	104
		IL No. 6	142	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	134	From low severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99

(Continued)

Table 281 (Concluded)

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	EDS	IL No. 6	134	From moderate severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	116	From high severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		Wyodak	150	Raffinate from continuous extraction (4:1 sulfolane feed) of 350-525°F hydrotreated solvent from one tpd pilot plant	99
	H-Coal	IL No. 6 (Burning Star Mine)	108	Single-stage hydrotreated <554°F distillate from PDU#	88
		Wyodak	>100	Single-stage hydrotreated <554°F distillate from PDU#	88
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via ASTM D-96.

‡See General Comments section, Note 4, for summary of operating conditions used.

§See General Comments section, Note 6, for summary of operating conditions used.

#See General Comments section, Note 7, for summary of operating conditions used.

Table 282. Smoke Point

Material	Process	Coal Type	Value (mm)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	6[†]	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	8[†]	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	9[†]	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	7[†]	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	H-Coal	IL No. 6	6	380-650°F distillate from PDU Run 5, Run 130-82, Period 29[‡]	111
Coal raw middle distillate blends (light fuel oils)	NA	--	--	--	--
Hydro-treated distillates (jet/diesel/other light fuel oil)	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	22	Single-stage hydrotreated <554°F distillate[§]	88
	EDS	IL No. 6	7.8	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	7.8	From low severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99

(Continued)

Table 282 (Concluded)

Material	Process	Coal Type	Value (mm)	Sample Description/Source	Reference
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	EDS	IL No. 6	6.9	From moderate severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	17.2	From high severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		Wyodak	15	Raffinate from continuous extraction (4:1 sulfolane: feed) of 350-525°F hydrotreated solvent from one tpd pilot plant	99
	H-Coal	IL No. 6 (Burning Star Mine)	23	Single-stage hydrotreated <554°F distillate from PDU#	88
		Wyodak	21	Single-stage hydrotreated <554°F distillate from PDU#	88
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via ASTM D-1322.

‡See General Comments section, Note 4, for summary of operating conditions used.

§See General Comments section, Note 6, for summary of operating conditions used.

#See General Comments section, Note 7, for summary of operating conditions used.

Table 283. Heat of Combustion

Material	Process	Coal Type	Value (BTU/lb)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I[*]	KY No. 9	17,415[†]	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	17,285[†]	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	18,458[†]	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	18,384[†]	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	SRC-II	NA	17,102 (gross)	Ft. Lewis pilot plant	84
		Pittsburgh No. 8 (Powhattan Mine)	17,000 (HHV) 16,190 (LHV)	Ft. Lewis pilot plant	101
		NA	17,235 (net)	Ft. Lewis pilot plant	102
		NA	17,260	Ft. Lewis pilot plant	126
		NA	16,391	Ft. Lewis pilot plant	122
	H-Coal	IL No. 6	17,706	380-650°F distillate from PDU Run 5, Run 130-82, Period 29[‡]	111
		Wyodak	18,523	380-650°F distillate from PDU Run 6, Run 130-83, Period 17[§]	112

(Continued)

Table 283 (Continued)

Material	Process	Coal Type	Value (BTU/lb)	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	NA	18,331 (gross)	450-650°F distillate from PDU (EPRI Sample No. 3)	84
		NA	17,670 (net) 18,700 (gross)	260-552°F distillate derived from atmospheric still overhead streams (analyzed by Truesdail)	108
		IL No. 6	18,068	PDU, syncrude mode	109
		Wyodak	18,616	PDU, syncrude mode	109
		W. KY No. 11	17,937	PDU, syncrude mode	109
Coal raw middle distillate blends (light fuel oils)	SRC-II	NA	17,330 (HHV) 16,490 (LHV)	5.75/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		Pittsburgh No. 8 (Powhattan Mine)	17,110 (HHV) 16,340 (LHV)	2.9/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		NA	17,090	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant	84
		NA	16,470 (net) 17,300 (gross)# 17.605 (gross)**	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant (analyzed by Truesdail and Gulf)	108
		NA	17,081	5.75/1 medium/heavy distillate blend	121
		NA	17,590	3/1 medium/heavy distillate blend, from Ft. Lewis pilot plant	126
		NA	17,140	2/1 medium/heavy distillate blend, from Ft. Lewis pilot plant	126

(Continued)

Table 283 (Concluded)

Material	Process	Coal Type	Value (BTU/lb)	Sample Description/Source	Reference
Coal raw middle distillate blends (light fuel oils)	SRC-II	NA	17,130	1/2 medium/heavy distillate from Ft. Lewis pilot plant	126
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	EDS	IL No. 6	20,500 (HHV)	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	104
		Wyodak	18,000 (net)	Raffinate from continuous extraction (4:1 sulfolane: feed) of 350-525°F boiling range hydrotreated solvent from one tpd pilot plant)	99
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via ASTM D-240.

‡See General Comments section, Note 4, for summary of operating conditions used.

§See General Comments section, Note 5, for summary of operating conditions used.

#Analyzed by Truesdail Laboratories.

**Analyzed by Gulf Oil.

Table 284. Aniline Point

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	25†	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	<-50†	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	<-50†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	<-50†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	EDS	IL No. 6	-5.5	Raw 350-650°F distillate from one tpd pilot plant	99
Coal raw middle distillate blends (light fuel oil)	NA	--	--	--	--
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	EDS	IL No. 6	<-36	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
	SRC-II	IL No. 6	-25	From low severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	-13.5	From moderate severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99

(Continued)

Table 284 (Concluded)

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	EDS	IL No. 6	+102.5	From high severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via ASTM D-611.

Table 285. Bromine Number

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I[*]	KY No. 9	33.0[†]	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
	EDS	IL No. 6	16.1	Raw 350-650°F distillate from one tpd pilot plant	99
	H-Coal	IL No. 6	50.4	380-650°F distillate from PDU Run 5, Run 130-82, Period 29[‡]	111
		Wyodak	21.6	380-650°F distillate from PDU Run 6, Run 130-83, Period 17[§]	112
Coal raw middle distillate blends (light fuel oils)	NA	--	--	--	--
Hydrotreated middle distillates (jet/diesel/ other light fuel oil)	EDS	IL No. 6	9.8	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	2.0	From low severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	1.7	From moderate severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	0.44	From high severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99

(Continued)

Table 285 (Concluded)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via ASTM D-1159.

‡See General Comments section, Note 4, for summary of operating conditions used.

§See General Comments section, Note 5, for summary of operating conditions used.

Table 286. Copper Strip Corrosion

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	1a†	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	1a†	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	1a†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	1a†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	EDS	IL No. 6	1a	Raw 350-650°F distillate from one tpd pilot plant	99
Coal raw middle distillate blends (light fuel oils)	NA	--	--	--	--
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	1	Single-stage hydrotreated <554°F distillate‡	88
	EDS	IL No. 6	1b	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	2c	From low severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99

(Continued)

Table 286 (Concluded)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Hydrotreated middle distillates (jet/diesel/ other light fuel oil)	EDS	IL No. 6	2c	From moderate severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	3b	From high severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		Wyodak	1.2 (2 hr at 212°F)	Raffinate from continuous extraction (4:1 sulfolane: feed) of 350-525°F hydrotreated solvent from one tpd pilot plant	99
	H-Coal	IL No. 6 (Burning Star Mine)	1	Single-stage hydrotreated <554°F distillate from PDU§	88
		Wyodak	1	Single-stage hydrotreated <554°F distillate from PDU§	88
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via ASTM D-130.

‡See General Comments section, Note 6, for summary of operating conditions used.

§See General Comments section, Note 7, for summary of operating conditions used.

Table 287. Moisture Content

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	0.04†	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	0.05†	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	0.03†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	0.03†	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
Coal raw middle distillate blends (light fuel oils)	NA	--	--	--	--
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	NA	--	--	--	--
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via ASTM D-1744 (Karl Fischer reagent method).

Table 288. Color

Material	Process	Coal Type	Value[†]	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	7 (medium brown)	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	8[††] (extremely dark brown)	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	4.5 (medium to dark amber)	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	2.25 (dark yellow to light amber)	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	EDS	IL No. 6	>8 (very dark brown)	Raw 350-650°F distillate from one tpd pilot plant	99
	H-Coal	IL No. 6 (Burning Star Mine)	Brownish black	Derived from PDU atmospheric still overhead and vacuum still overhead streams, fuel oil mode (analyzed by BETC)[‡]	97
		IL No. 6 (Monterey Mine)	Brownish black	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)[‡]	97
Coal raw middle distillate blends (light fuel oils)	NA	--	--	--	--

(Continued)

Table 288 (Concluded)

Material	Process	Coal Type	Value†	Sample Description/Source	Reference
Hydrotreated distillates (jet/diesel/ other light fuel oils)	EDS	IL No. 6	>8 (very dark brown)	Partially hydrotreated 350-650° distillate from one tpd pilot plant	99
		IL No. 6	3 (light amber)	From low severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	2 (dark yellow)	From moderate severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	1 (pale yellow)	From high severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via ASTM D-1500.

‡See General Comments section, Note 3, for summary of operating conditions used.

Table 289. Oxygen Content

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	3.39	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	2.97	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	0.23	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	0.1	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	SRC-II	NA	4.65	Ft. Lewis pilot plant	84
		Pittsburg No. 8 (Powhattan Mine)	5.43[†]	Ft. Lewis pilot plant	101
		NA	3.89	Ft. Lewis pilot plant	102
		NA	3.8[†]	Ft. Lewis pilot plant	126
	H-Coal	IL No. 6	1.03	380-650°F distillate from PDU Run 5, Run 130-82, Period 29[‡]	111
		Wyodak	1.24	30-650°F distillate from PDU Run 6, Run 130-83, Period 17[§]	112
		NA	1.2	>450-650°F distillate from PDU	84

(Continued)

Table 289 (Continued)

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	IL No. 6	0.94	450-650°F distillate from PDU, syncrude mode	98
		NA	2.08 1.64	260-552°F distillate derived from atmospheric still overhead streams(analyzed by Truesdail and Graphic Science for EPRI)	108
		IL No. 6	1.0	PDU, syncrude mode	109
		Wyodak	0.7	PDU, syncrude mode	109
		W. KY No. 11	1.6	PDU, syncrude mode	109
Coal raw middle distillate blends (light fuel oil)	SRC-II	NA	4.02†	5.75/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		Pittsburg No. 8 (Powhattan Mine)	4.18†	2.9/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		NA	4.35	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant	84
		NA	3.74† 4.35† 4.18†	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant (analyzed by Truesdail, Mobil for EPRI, and Gulf)	108
		NA	2.02	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-6	113

(Continued)

Table 289 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw middle distillate blends (light fuel oil)	SRC-II	NA	1.73	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-7	113
		NA	4.38	5.75/1 medium/heavy distillate blend	121
		NA	3.8[†]	3/1 medium/heavy distillate blend, from Ft. Lewis pilot plant	126
		NA	2.1[†]	2/1 medium/heavy distillate blend, from Ft. Lewis pilot plant	126
Hydrotreated middle distillates (jet/diesel/ other light fuel oil)		IL No. 6	1.1700	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	0.1300	From low severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
	EDS	IL No. 6	0.1700	From moderate severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	NA	From high severity, hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99

(Continued)

Table 289 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated middle distillate blends (light fuel oils)	SRC-II	NA	1.08	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-21	113
		NA	0.98	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, 400°F$^+$ liquid product, UOP Sample No. 3777-34	113
		NA	0.67	Severely hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-28	113
		NA	0.83	Severely hydrotreated 2.9/1 medium/heavy distillate blend, 400°F$^+$ liquid product, UOP Sample No. 3777-41	113

Explanatory Notes:

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

+By difference.

‡See General Comments section, Note 4, for summary of operating conditions used.

§See General Comments section, Note 5, for summary of operating conditions used.

Table 290. Sulfur Content

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	0.38	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	0.45	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	0.082	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer -29, APCI Sample No. 1941CB-1)	82
		KY No. 9	0.03	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	SRC-II	NA	0.21	Ft. Lewis pilot plant	84
		Pittsburg No. 8 (Powhattan Mine)	0.20	Ft. Lewis pilot plant	101
		NA	0.19	Ft. Lewis pilot plant	102
		NA	0.20	Ft. Lewis pilot plant	122
		NA	0.3	Ft. Lewis pilot plant	126
	EDS	IL No. 6	0.7870	Raw 350-650°F distillate from one tpd pilot plant	99
	H-Coal	IL No. 6 (Burning Star Mine)	0.29	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)†	97
		IL No. 6 (Burning Star Mine)	0.371	PDU (Ashland Oil sample)	96

(Continued)

Table 290 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	IL No. 6 (Monterey Mine)	0.35	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)†	97
		Wyodak	<0.03	380-650°F distillate from PDU Run 6, Run 130-83, Period 17‡	112
		NA	0.09	>450-650°F distillate from PDU	84
		IL No. 6	0.18	450-650°F distillate from PDU, syncrude mode	98
		IL No. 6 (Burning Star Mine)	0.0371	PDU (Ashland Oil sample)	96
		NA	0.094 0.14	260-552°F distillate derived from atmospheric still overhead streams (analyzed by Truesdail and Graphic Science for EPRI)	108
		IL No. 6	0.1	PDU, syncrude mode	109
		Wyodak	0.02	PDU, syncrude mode	109
		W.KY No. 11	0.1	PDU, syncrude mode	109
Coal raw middle distillate blends (light fuel oil)	SRC-II	NA	0.26	5.75/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		Pittsburg No. 8 (Powhattan Mine)	0.26	2.9/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		NA	0.23	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant	84

(Continued)

Table 290 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw middle distillate blends (light fuel oil)	SRC-II	NA	0.22 0.23 0.19	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant (analyzed by Truesdail, Mobil for EPRI, and Gulf)	108
		NA	0.3300	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-6	113
		NA	0.3815	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-7	113
		NA	0.30	Medium and heavy distillate blend	114
		NA	0.22	5.75/1 medium/heavy distillate blend	121
		NA	0.2	3/1 medium/heavy distillate blend, from Ft. Lewis pilot plant	126
		NA	0.4	2/1 medium/heavy distillate blend, from Ft. Lewis pilot plant	126
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	EDS	IL No. 6 (Monterey Mine)	0.004	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	104
		IL No. 6	0.0270	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	99

(Continued)

Table 290 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated middle distillates (jet/ diesel/ other light fuel oil)	EDS	IL No. 6	0.0015	From low severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	ND	From moderate severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	ND	From high severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
Hydrotreated middle distillate blends (light fuel oils)	SRC-II	NA	0.0129	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-21	113
		NA	0.0106	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, 400°F$^+$ liquid product, UOP Sample No. 3777-34	113
		NA	0.0098	Severely hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-28	113

(Continued)

Table 290 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated middle distillate blends (light fuel oils)	SRC-II	NA	0.0109	Severely hydrotreated 2.9/1 medium/heavy distillate blend, 400°F liquid product, UOP Sample No. 3777-41	113

Explanatory Notes:

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†See General Comments section, Note 3, for summary of operating conditions used.

‡See General Comments section, Note 5, for summary of operating conditions used.

Table 291. Nitrogen Content

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	0.75	Wilsonville pilot plant SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	0.93	Wilsonville pilot plant SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	0.18	Wilsonville pilot plant Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	0.22	Wilsonville pilot plant Lummus LC-Finer unit (Lummus Run No. 2LC Finer-27, APCI Sample No. 1949CB)	82
	SRC-II	NA	0.91	Ft. Lewis pilot plant	84
		Pittsburg No. 8 (Powhattan Mine)	0.85	Ft. Lewis pilot plant	101
		NA	0.95	Ft. Lewis pilot plant	102
		NA	0.87	Ft. Lewis pilot plant	122
		NA	0.9	Ft. Lewis pilot plant	126
	EDS	IL No. 6	0.6700	Raw 350-650°F distillate from one tpd pilot plant	99
	H-Coal	IL No. 6 (Burning Star Mine)	0.446	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)†	97
		IL No. 6 (Burning Star Mine)	0.1800	PDU (Ashland Oil sample)	96

(Continued)

Table 291 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	IL No. 6 (Monterey Mine)	0.871	Derived from PDU atmospheric still overhead and vacuum still overhead streams, syncrude mode (analyzed by BETC)[†]	97
		IL No. 6	0.52	380-650°F distillate from PDU Run 5, Run 130-82, Period 29[‡]	111
		Wyodak	0.23	380-650°F distillate from PDU Run 6, Run 130-83, Period 17[§]	112
		NA	0.33	>450-650°F distillate from PDU	84
		IL No. 6	0.42	450-650°F distillate from PDU, syncrude mode	98
		IL No. 6 (Burning Star Mine)	0.1800	PDU (Ashland Oil sample)	96
		NA	0.31 0.26	260-552°F distillate derived from atmospheric still overhead streams (analyzed by Truesdail and Graphic Science for EPRI)	108
		IL No. 6	0.4	PDU, syncrude mode	109
		Wyodak	0.3	PDU, syncrude mode	109
		W.KY No. 11	0.5	PDU, syncrude mode	109
Coal raw middle distillate blends (light fuel oil)	SRC-II	NA	0.84	5.75/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		Pittsburg No. 8 (Powhattan Mine)	0.92	2.9/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		NA	0.91	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant	84

(Continued)

Table 291 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw middle distillate blends (light fuel oil)	SRC-II	NA	0.86 0.91 0.93	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant (analyzed by Truesdail, Mobil for EPRI, and Gulf)	108
		NA	0.8100	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-6	113
		NA	0.9040	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-7	113
		NA	0.97	Medium and heavy distillate blend	114
		NA	1.02	5.75/1 medium/heavy distillate blend	121
		NA	0.9	3/1 medium/heavy distillate blend, from Ft. Lewis pilot plant	126
		NA	0.9	2/1 medium/heavy distillate blend, from Ft. Lewis pilot plant	126
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	EDS	IL No. 6 (Monterey Mine)	<0.001	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	104
		IL No. 6	0.170	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	0.0185	From low severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99

(Continued)

Table 291 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	EDS	IL No. 6	0.130	From moderate severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	<0.0100	From high severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
Hydrotreated middle distillate blends (light fuel oils)	SRC-II	NA	0.5510	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-21	113
		NA	0.6000	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, 400°F^{+} liquid product, UOP Sample No. 3777-34	113
		NA	0.1900	Severely hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-28	113
		NA	0.1730	Severely hydrotreated 2.9/1 medium/heavy distillate blend, 400°F liquid product, UOP Sample No. 3777-41	113

Explanatory Notes:

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†See General Comments section, Note 3, for summary of operating conditions used.

‡See General Comments section, Note 4, for summary of operating conditions used.

§See General Comments section, Note 5, for summary of operating conditions used.

Table 292. Carbon Content

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	86.56	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	87.79	Wilsonville pilot plant SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	89.62	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	89.98	Wilsonville pilot plant Lummus LC-Finer unit (Lummus Run No. 2LC Finer-27, APCI Sample No. 1949CB)	82
	SRC-II	NA	85.9	Ft. Lewis pilot plant	126
		Pittsburg No. 8 (Powhattan Mine)	84.59	Ft. Lewis pilot plant	101
		NA	85.77	Ft. Lewis pilot plant	102
	H-Coal	IL No. 6	87.54	380-650°F distillate from PDU Run 5, Run 130-82, Period 29†	111
		Wyodak	88.63	380-650°F distillate from PDU Run 6, Run 130-83, Period 17‡	112
		IL No. 6	88.3	450-650°F distillate from PDU, syncrude mode	98

(Continued)

Table 292 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	NA	86.20 86.53	260-552°F distillate derived from atmospheric still overhead streams (analyzed by Truesdail and Graphic Science for EPRI)	108
		IL No. 6	88.8	PDU, syncrude mode	109
		Wyodak	86.6	PDU, syncrude mode	109
		W.KY No. 11	88.5	PDU, syncrude mode	109
Coal raw middle distillate blends (light fuel oil)	SRC-II	NA	85.64	5.75/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		Pittsburg No. 8 (Powhattan Mine)	86.15	2.9/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		NA	86.09 84.69 85.93	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant (analyzed by Truesdail, Mobil for EPRI, and Gulf)	108
		NA	85.83	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-6	113
		NA	86.13	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-7	113
		NA	85.91	Medium and heavy distillate blend	114
		NA	85.50	5.75/1 medium/heavy distillate blend	121
		NA	86.2	3/1 medium/heavy distillate blend, from Ft. Lewis pilot plant	126
		NA	87.5	2/1 medium/heavy distillate blend, from Ft. Lewis pilot plant	126

(Continued)

Table 292 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	EDS	IL No. 6	89.58	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	88.86	From low severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	87.98	From moderate severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	87.10	From high severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
Hydrotreated middle distillate blends (light fuel oils)	SRC-II	NA	86.91	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-21	113
		NA	86.84	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, 400°F$^+$ liquid product, UOP Sample No. 3777-34	113
		NA	87.17	Severely hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-28	113

(Continued)

Table 292 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated middle distillate blends (light fuel oils)	SRC-II	NA	84.86	Severely hydrotreated 2.9/1 medium/heavy distillate blend, 400°F liquid product, UOP Sample No. 3777-41	113

Explanatory Notes

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†See Part I, General Comments section, Note 4, for summary of operating conditions used.

‡See Part I, General Comments section, Note 5, for summary of operating conditions used.

Table 293. Hydrogen Content

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	8.68	Wilsonville pilot plant SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	8.20	Wilsonville pilot plant SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	10.09	Wilsonville pilot plant Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-19, APCI Sample No. 1941CB-1)	82
		KY No. 9	9.51	Wilsonville pilot plant Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	SRC-II	NA	8.83	Ft. Lewis pilot plant	84
		Pittsburgh No. 8 (Powhattan Mine)	8.84	Ft. Lewis pilot plant	101
		NA	9.20	Ft. Lewis pilot plant	102
		NA	9.07	Ft. Lewis pilot plant	122
		NA	9.0	Ft. Lewis pilot plant	126
	H-Coal	IL No. 6	9.57	380-650°F distillate from PDU Run 5, Run 130-82, Period 29†	111
		Wyodak	10.69	380-650°F distillate from PDU Run 6, Run 130-83, Period 17‡	112

(Continued)

Table 293 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	NA	10.03	>450-650°F distillate from PDU	84
		IL No. 6	9.7	450-650°F distillate from PDU, syncrude mode	98
		NA	11.19 11.43	260-552°F distillate derived from atmospheric still overhead streams (analyzed by Truesdail and Graphic Science for EPRI)	108
		IL No. 6	9.7	PDU, syncrude mode	109
		Wyodak	10.6	PDU, syncrude mode	109
		W.KY No. 11	9.3	PDU, syncrude mode	109
Coal raw middle distillate blends (light fuel oil)	SRC-II	NA	9.24	5.75/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		Pittsburg No. 8 (Powhattan Mine)	8.48	2.9/1 medium/heavy distillate blend from Ft. Lewis pilot plant	101
		NA	8.70	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant	84
		NA	9.08 8.70 8.64	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant (analyzed by Truesdail, Mobil for EPRI, and Gulf)	108
		NA	8.68	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-6	113
		NA	8.72	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-7	113

(Continued)

Table 293 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw middle distillate blends (light fuel oil)	SRC-II	NA	8.74	Medium and heavy distillate blend	114
		NA	8.86	5.75/1 medium/heavy distillate blend	121
		NA	8.9	3/1 medium/heavy distillate blend, from Ft. Lewis pilot plant	126
		NA	8.5	2/1 medium/heavy distillate blend, from Ft. Lewis pilot plant	126
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	EDS	IL No. 6 (Monterey Mine)	13	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	104
		IL No. 6	9.10	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	10.97	From low severity, hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
	EDS	IL No. 6	11.84	From moderate severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	12.83	From high severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99

(Continued)

Table 293 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated middle distillate blends (light fuel oil)	SRC-II	NA	10.38	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-21	113
		NA	9.98	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, 400°F$^+$ liquid product, UOP Sample No. 3777-34	113
		NA	11.18	Severely hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-28	113
		NA	10.59	Severely hydrotreated 2.9/1 medium/heavy distillate blend, 400°F liquid product, UOP Sample No. 3777-41	113

Explanatory Notes:

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†See General Comments section, Note 4, for summary of operating conditions used.

‡See General Comments section, Note 5, for summary of operating conditions used.

Table 294A. Trace Elements Content (Qualitative Data)

Material	Process	Coal Type	Trace Metals Present		Sample Description/Source	Reference
Coal raw middle distillates	SRC-I*	KY No. 9	Major	Fe,Si	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
			Minor	Ca,K,Zn, Ti,Al		
			Trace	Cr,Mn,Ni, Cu,As,Zr,Mo		
		KY No. 9	Major	Al,Si,Fe	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
			Minor	K,Ca,Mo, Ti,Zn		
			Trace	Cr,Mn,Ni,Zr, Cu,As,Pb,Sr		
		KY No. 9	Major	Si,Fe	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
			Minor	Al,K,Ca, Ti,Zn		
			Trace	V,Ni,Cu,Ga, Ge,As,Pb,Sr, Zr and Ba		
		KY No. 9	Major	Si,Ca	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
			Minor	Al,Fe,Ti, K,Cu,Zn,Zr		
			Trace	Mn,Ni,As		

Explanatory Notes:

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

Table 294B. Trace Elements Content (Quantitative Data)(ppmw)

Material	Process	Coal Type	Ti	Na	K	Ca	V	Pb	Fe	P	Cd	Cr	Mn	Mg	Ni	Zn	Cu	Si	Sn
Coal raw middle distillates	SRC-II	NA	<0.1	5.0	2.0	0.52	0.12	0.29	2.1	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	<0.012	5.1	0.19	0.35	<0.02	<0.16	0.69	<0.8	<0.05	0.39	0.04	0.35	<0.05	0.03	<0.03	1.75	<0.06
	H-Coal	NA	<0.1	0.67	0.26	0.29	<0.1	0.14	3.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA 0.02	0.15 NA	NA NA	0.31 0.18	<0.04 0.003	NA 0.27	38.0 52.0	NA NA	NA 0.17	NA NA	0.07 0.11	0.04 0.16	0.08 0.03	NA 14.0	NA 2.6	NA 0.81	NA 0.32
		NA	NA	1.1	0.20	NA	NA	NA	3.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		IL No. 6 (Burning Star Mine	NA	NA	NA	NA	0.2	NA	1.0	NA	NA	NA	NA	NA	0.2	NA	NA	NA	NA
		IL No. 6	ND(2)	0.2	0.03	0.10	0.2	0.1	2.2	NA	NA	NA	NA	0.01	0.1	NA	NA	ND(5)	NA
		Wyodak	ND(2)	0.39	0.05	0.11	0.1	0.1	0.8	NA	NA	NA	NA	0.02	0.1	NA	NA	ND(5)	NA
		W. KY 11	0.01	8.1	5.7	0.38	<0.02	<0.15	1.7	NA	NA	NA	NA	0.23	0.1	NA	NA	26	NA
		IL No. 6 (Burning Star Mine)	NA	NA	NA	NA	0.2	NA	1.0	NA	NA	NA	NA	NA	0.2	NA	NA	NA	NA
Coal raw middle distillate blends (light fuel oil)	SRC-II	NA	0.5	1.4	1.5	1.6	0.23	0.12	13	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA 0.85	0.39 <0.10	NA NA	1.5 1.5	<1.0 0.03	NA 0.17	13.0 13.0	NA NA	NA 0.15	NA 1.4	0.22 0.26	0.34 1.40	0.11 0.10	NA 0.60	NA 0.23	NA 24.0	NA 1.03
		NA	0.5	1.4	1.5	1.6	0.23	0.12	13.0	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hydrotreated middle distillates (jet/diesel/ other light fuel oil)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hydrotreated middle distillate blends (light fuel oil)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

(Continued)

Table 294B (Concluded)

B	Mo	Ag	Co	Al	As	Hg	Sb	Ba	Be	Bi	Se	Sr	W	U	Sample Description/Source	Reference
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Ft. Lewis pilot plant	84
0.1	<0.08	<0.06	<0.04	<0.4	0.004‡	ND	0.003‡	0.02	<0.006	1.0	0.002	ND	ND	NA	Ft. Lewis pilot plant	125
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	>450-650°F distillate from PDU	84
NA 0.06	NA 0.05	NA 0.001	NA 0.005	NA 0.50	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	260-552°F distillate derived from atmospheric still overhead streams (analyzed by Truesdail and Graphic Science for EPRI)*,†	108
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	PDU (Ashland Oil Sample)	96
NA	ND (0.01)	NA	ND (0.01)	1.5	0.005	0.14	NA	NA	NA	NA	NA	NA	NA	NA	PDU syncrude mode	109
NA	ND (0.06)	NA	0.3	1.9	0.005	ND (0.007)	NA	NA	NA	NA	NA	NA	NA	NA	PDU syncrude mode	109
NA	<0.02	NA	<0.04	1.1	0.018	0.04	NA	NA	NA	NA	NA	NA	NA	NA	PDU syncrude mode	109
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	PDU (Ashland oil sample)	96
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant	84
NA 0.31	NA 0.03	NA 0.002	NA 0.02	NA 13.0	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	5/1 medium/heavy distillate blend from Ft. Lewis pilot plant (2 samples analyzed by Truesdail and one sample by Mobil for EPRI)*,†	108
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA

Explanatory Notes

*All values in first 2 rows by wet chemical method.

†All values in third row by spectographic method.

‡Determined by flameless AAS. All other elements were determined by ICP.

Table 295. Ash Content (by Ultimate Analysis)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw middle distillates	SRC-II	NA	0.10	Ft. Lewis pilot plant	126
		NA	0.60	2/1 medium/heavy distillate blend, from Ft. Lewis pilot plant	126
Coal raw middle distillate blend (light fuel oil)	NA	--	--	--	--
Hydrotreated middle distillates (jet/diesel other light fuel oil)	NA	--	--	--	--
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--

Table 296. Saturates, Olefins and Aromatics Contents

Material	Process	Coal Type	Value (vol %)	Sample Description/Source	Reference
A. Saturates					
Coal raw middle distillates	SRC-I*	KY No. 9	61.98[†] (wt %)	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	62.58[†] (wt %)	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	86.09[†] (wt %)	Wilsonville pilot plant Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	87.57[†] (wt %)	Wilsonville pilot plant Lummus LC-Finer unit (Lummus Run No. 2 LC Finer-27, APCI Sample No. 1949CB)	82
	EDS	IL No. 6	22.2[‡]	Raw 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	42	450-650°F distillate from PDU, syncrude mode	98
Coal raw middle distillate blends (light fuel oil)	SRC-II	NA	9.9	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-6	113
			9.4	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-7	113

(Continued)

Table 296 (Continued)

Material	Process	Coal Type	Value (vol %)	Sample Description/Source	Reference
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	EDS	IL No. 6	14.2[‡]	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	17.2[‡]	From low severity, hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	26.0[‡]	From moderate severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	84.2[‡]	From high severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
Hydrotreated middle distillate blends (light fuel oils)	SRC-II	NA	21.2	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-21	113
		NA	10.7	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, 400°F† liquid product, UOP Sample No. 3777-34	113
		NA	42.9	Severely hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-28	113
		NA	26.1	Severely hydrotreated 2.9/1 medium/heavy distillate blend, 400°F liquid product, UOP Sample No. 3777-41	113

(Continued)

Table 296 (Continued)

Material	Process	Coal Type	Value (vol %)	Sample Description/Source	Reference
B. Olefins					
Coal raw middle distillates	EDS	IL No. 6	9.2‡	Raw 350-650°F distillate from one tpd pilot plant	99
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	EDS	IL No. 6	0.9‡	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	5.5‡	From low severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	1.7‡	From moderate severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	3.9‡	From high severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
Hydrotreated middle distillate blends (light fuel oils)	NA	--	--	--	--
Coal raw middle distillate blends (light fuel oil)	NA	--	--	--	--

(Continued)

Table 296 (Continued)

Material	Process	Coal Type	Value (vol %)	Sample Description/Source	Reference
C. Aromatics					
Coal raw middle distillates	SRC-I*	KY No. 9	21.82[†] (wt %)	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
		KY No. 9	16.67[†]	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
		KY No. 9	0.20[†]	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	1.06[†]	Wisonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
	EDS	IL No. 6	68.6[‡]	Raw 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	58	450-650°F distillate from PDU, syncrude mode	98
Coal raw middle distillate blends (light fuel oil)	SRC-II	NA	90.1	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-6	113
		NA	54.4	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-7	113
Hydrotreated middle distillates (jet/diesel/other light fuel oil)	EDS	IL No. 6	84.9[‡]	Partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	77.3[‡]	From low severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99

(Continued)

Table 296 (Concluded)

Material	Process	Coal Type	Value (vol %)	Sample Description/Source	Reference
Hydrotreated middle distillates (jet/ diesel/ other light fuel oil)	EDS	IL No. 6	72.3‡	From moderate severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
		IL No. 6	11.9‡	From high severity hydrotreatment of partially hydrotreated 350-650°F distillate from one tpd pilot plant	99
Hydrotreated middle distillate blends (light fuel oil)	SRC-II	NA	59.1	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-21	113
		NA	69.9	Moderately hydrotreated 2.9/1 medium/heavy distillate blend, 400°F+ liquid product, UOP Sample No. 3777-34	113
		NA	50.8	Severely hydrotreated 2.9/1 medium/heavy distillate blend, whole liquid product, UOP Sample No. 3777-28	113
		NA	73.9	Severely hydrotreated 2.9/1 medium/heavy distillate blend, 400°F+ liquid product, UOP Sample No. 3777-41	113

Explanatory Notes:

*The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined via APCI absorption chromatography method.

‡FIA analysis

Table 297. Detailed Hydrocarbon Class/Compound Analysis*

			Value			
Material	Process	Coal Type	Compound Class	Wt %	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I†	KY No. 9	Phenanthrene	5.2‡	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
			Naphthalene	4.5		
			2-Methyl-Naphthalene	3.7		
			2-Methyl-1-Propyl-Naphthalene	2.2		
			a Dimethyl-Naphthalene	2.1		
			1,2,3,4-Tetrahydro-Naphthalene	1.8		
			2-Ethyl-Naphthalene	1.8		
			Tetradecane	1.7		
			a Methyl-9H-Fluorene	1.6		
			a B-Methyl-Naphthalene	1.6		
			2-Isopropyl-Naphthalene	1.3		
			Heptadecane	1.2		
			4-Methyl-1,1-Biphenyl	1.2		
			Dibenzofuran	1.2		
			C2-Alkyl-Biphenyl	1.2		
			an n-Propyl Naphthalene	1.1		
			5- or 6-Methyl-Tetrahydro-Naphthalene	1.1		
		KY No. 9	Phenanthrene	9.1‡	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
			2-Methyl-Naphthalene	7.1		
			Naphthalene	6.1		
			Dibenzofuran	3.4		
			a Dimethyl-Naphthalene	2.8		
			9H-Fluorene	2.7		
			1,2,3,4-Tetrahydro-Naphthalene	2.6		
			1,2-Dihydroxy-Ace-Naphthalene	2.3		
			a Methyl-9H-Fluorene	2.3		
			1,1'-Biphenyl	2.1		
			1-Methyl-Naphthalene	1.5		
			2-Ethyl-Naphthalene	1.5		
			5-/6-Methyl-Tetrahydro-Naphthalene	1.5		
			a Dimethyl-Naphthalene	1.2		
			a Propyl-Naphthalene	1.0		
			Hexadecane	1.0		
			a Methyl-9H-Fluorene	1.0		

(Continued)

Table 297 (Continued)

			Value			
Material	Process	Coal Type	Compound Class	Wt %	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I[†]	KY No. 9	2-Butyl-Naphthalene	3.8[†]	Wilsonville pilot plant Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
			Phenanthrene	3.4		
			Methyl-Tetrahydroxy Phenanthrene	3.2		
			a Dimethyl-Biphenyl	3.0		
			C4-Alkyl-Tetrahydro-Naphthalene	3.0		
			a Dimethyl-Biphenyl	2.4		
			a Methyl-Biphenyl	2.2		
			a Methyl-Phenanthrene	2.2		
			a C2-Alkyl-Biphenyl	2.2		
			a Methyl-Tetrahydro-Naphthalene	2.2		
			1,2,3,4-Tetrahydro-Naphthalene	2.1		
			a Methyl-Tetrahydro-Naphthalene	2.2		
			C2-Alkyl-Octahydro-Phenanthrene	2.0		
			4 component mixture	2.0		
			4 component mixture	1.9		
			Octahydro-Phenanthrene	1.9		
			2-Methyl-Naphthalene	1.7		
			peak not part of assembled MS B-Tetrahydro-Naphthalene	1.5		
			Propyl-Dihydro-Naphthalene	1.4		
		KY No. 9	2-Butyl-Naphthalene	4.2[†]	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
			Perinaphthrene	3.6		
			1,2,3,4-Tetrahydro-Naphthalene	3.2		
			Phenanthrene	3.1		
			a Methyl-9H-Fluorene	2.6		
			5-/6-Methyl-1,2,3,4-Tetrahydro-Naphthalene	2.5		
			C4-Alkyl-Tetrahydro-Naphthalene	2.3		
			2-Methyl-Naphthalene	2.2		
			Unknown H-aromatic	2.0		
			Octahydro-phenanthrene	1.9		
			Methyl-B-Naphthalene	1.9		
			a Di-Methyl-Biphenyl	1.8		
			Unknown mixture	1.4		

(Continued)

Table 297 (Continued)

Material	Process	Coal Type	Value Compound Class	Wt %	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I†	KY No. 9	9H-Fluorene	1.4		
			Octahydro-phenanthrene	1.4		
			M-Tetrahydro-Phenanthrene	1.4		
			4-Methyl-Biphenyl	1.4		
			Unknown mixture	1.3		
			3-T-Butyl-1-2 Dihydro-Naphthalene	1.3		
			Unknown mixture	1.3		
	H-Coal	IL No. 6	Z No. -8		380-650°F distillate from PDU Run 5, Run 130-82, Period 299	111
			Tetralins			
			Carbon No.	Pct		
			C_6	NA		
			C_7	NA		
			C_8	NA		
			C_9	0.2		
			C_{10}	2.5		
			C_{11}	6.6		
			C_{12}	4.6		
			C_{13}	3.5		
			C_{14}	3.3		
			C_{15}	1.9		
			C_{16}	0.8		
			C_{17}	0.5		
			C_{18}	0.2		
			C_{19}	0.1		
			C_{20}	0.0		
			C_{21}	0.0		
			C_{22}	0.1		
			C_{23}	0.0		
			C_{24}	0.0		
			C_{25}	0.0		
			Total	24.7		
			Z No. -10			
			Dinaphthenobenzenes or Indenes			
			C_6	NA		
			C_7	NA		
			C_8	NA		
			C_9	0.0		
			C_{10}	0.0		
			C_{11}	0.0		
			C_{12}	0.8		
			C_{13}	2.2		
			C_{14}	2.9		
			C_{15}	1.7		
			C_{16}	1.1		
			C_{17}	0.6		
			C_{18}	0.3		
			C_{19}	0.1		
			C_{20}	0.0		
			C_{21}	0.0		
			C_{22}	0.1		
			C_{23}	0.0		
			C_{24}	0.0		
			C_{25}	0.0		
			Total	9.8		

(Continued)

Table 297 (Continued)

Material	Process	Coal Type	Value Compound Class		Wt %	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	IL No. 6	Z No. -14				
			Biphenyls and Acenaphthenes				
			Carbon No.	Pct			
			C_6	NA			
			C_7	NA			
			C_8	NA			
			C_9	NA			
			C_{10}	NA			
			C_{11}	NA			
			C_{12}	0.5			
			C_{13}	2.9			
			C_{14}	3.6			
			C_{15}	2.3			
			C_{16}	1.2			
			C_{17}	0.7			
			C_{18}	0.3			
			C_{19}	0.1			
			C_{20}	0.0			
			C_{21}	0.1			
			C_{22}	0.0			
			C_{23}	0.0			
			C_{24}	0.0			
			C_{25}	0.0			
			Total	12.0			
			Z No. -16				
			Fluorines and Acenaphthenes				
			C_6	NA			
			C_7	NA			
			C_8	NA			
			C_9	NA			
			C_{10}	NA			
			C_{11}	NA			
			C_{12}	0.1			
			C_{13}	0.5			
			C_{14}	1.2			
			C_{15}	0.9			
			C_{16}	0.9			
			C_{17}	0.7			
			C_{18}	0.3			
			C_{19}	0.1			
			C_{20}	0.0			
			C_{21}	0.0			
			C_{22}	0.0			
			C_{23}	0.0			
			C_{24}	0.0			
			C_{25}	0.0			
			Total	4.9			

(Continued)

Table 297 (Continued)

			Value				
Material	Process	Coal Type	Compound Class		Wt %	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	IL No. 6	Z No. -18 Phenanthrenes and Anthracenes				
			Carbon No.	Pct			
			C_6	NA			
			C_7	NA			
			C_8	NA			
			C_9	NA			
			C_{10}	NA			
			C_{11}	NA			
			C_{12}	NA			
			C_{13}	NA			
			C_{14}	0.7			
			C_{15}	0.4			
			C_{16}	0.2			
			C_{17}	0.1			
			C_{18}	0.0			
			C_{19}	0.0			
			C_{20}	0.0			
			C_{21}	0.0			
			C_{22}	0.0			
			C_{23}	0.0			
			C_{24}	0.0			
			C_{25}	0.0			
			Total	1.4			
	H-Coal	Wyodak	Paraffins		16.7	380-650°F distillate from PDU Run 6, Run 130-83, Period 17[a]	112
			Monocycloparaffins		15.4		
			Dicycloparaffins		5.7		
			Tricycloparaffins		1.1		
			Total		38.9		
			Alkylbenzenes		10.5		
			Indans and Tetralins		20.8		
			Dinaphthenobenzenes		4.9		
			C_{10} Naphthalene		1.4		
			C_{11}^{+} Naphthalene		8.2		
			Biphenyls, etc.		7.8		
			Flourenes, etc.		4.8		
			Tricyclic Aromatics		2.7		
			Total Aromatics		61.1		
					100.00		

(Continued)

Table 297 (Continued)

Material	Process	Coal Type	Value Compound Class	Wt %	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	IL No. 6	X Class		PDU, syncrude mode	109
			Monoaromatics			
			-6 Alkyl Benzenes	7.0		
			-8 Naphthene Benzenes	22.9		
			-10 Di-Naphthene Benzenes	12.6		
			Diaromatics			
			-12 Naphthalenes	15.7		
			-14 Acenaphthenes, Biphenyls	10.6		
			-16 Fluorenes	3.4		
			Triaromatics			
			-18 Phenanthrenes	1.2		
			-20 Naphthene Phenanthrenes	0.0		
			Tetraaromatics			
			-22 Pyrenes, Fluoranthrenes	0.0		
			-24 Chrysenes	0.0		
			Pentaaromatics			
			-26 Benzofluoranthrenes	0.0		
			-28 Perylenes	0.0		
			-30 Dibenzanthracenes	0.0		
		Wyodak	X Class		PDU, syncrude mode	109
			Monoaromatics			
			-6 Alkyl Benzenes	9.2		
			-8 Naphthene Benzenes	26.9		
			-10 Di-Naphthene Benzenes	6.7		
			Diaromatics			
			-12 Naphthalenes	12.3		
			-14 Acenaphthenes, Biphenyls	4.0		
			-16 Fluorenes	1.1		
			Triaromatics			
			-18 Phenanthrenes	0.3		
			-20 Naphthene Phenanthrenes	0.0		
			Tetraaromatics			
			-22 Pyrenes, Fluoranthrenes	0.0		
			-24 Chrysenes	0.0		
			Pentaaromatics			
			-26 Benzofluoranthrenes	0.0		
			-28 Perylenes	0.0		
			-30 Dibenzanthracenes	0.0		

(Continued)

Table 297 (Continued)

Material	Process	Coal Type	Value Compound Class	Wt %	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	W. KY 11	X Class**		PDU, syncrude mode	109
			Monoaromatics			
			-6 Alkyl Benzenes	5.6		
			-8 Naphthene Benzenes	16.8		
			-10 Di-Naphthene Benzenes	8.4		
			Diaromatics			
			-12 Naphthalenes	15.2		
			-14 Acenaphthenes, Biphenyls	10.5		
			-16 Fluorenes	5.0		
			Triaromatics			
			-18 Phenanthrenes	2.5		
			-20 Naphthene Phenanthrenes	0.1		
			Tetraaromatics			
			-22 Pyrenes, Fluoranthrenes	0.0		
			-24 Chrysenes	0.0		
			Pentaaromatics			
			-26 Benzofluoranthrenes	0.0		
			-28 Perylenes	0.0		
			-30 Dibenzanthracenes	0.0		

(Continued)

Table 297 (Concluded)

Material	Process	Coal Type	z No.	Hydrocarbon Types Analysis Compound Types C_nH_{2n-z}††	Wt %	Average Molecular Weight	Sample Description/Source	Reference
Coal raw middle distillate blends (light fuel oils)	SRC-II	NA	z=-2	Paraffins	3.6	226	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-6	113
			z=0	1 Ring Naphthenes	1.3	224		
			z=2	2 Ring Naphthenes	1.8	208		
			z=4	3 Ring Naphthenes	1.3	206		
			z=6	4 Ring Naphthenes	0.4	190		
				Total Saturates	8.4	216		
			z No.	Aromatic Hydrocarbons Compound Types C_nH_{2n-z}††				
			z=6	Benzenes	0.9	158		
			z=8	Indans/Tetralins	10.3	165		
			z=10	Dinaphthene Benzenes	2.7	185		
			z=12	Naphthalenes	12.1	159		
			z=14	Acenaphthenes/Biphenyls	7.5	185		
			z=16	Fluorenes	4.4	205		
			z=18	Phenanthrenes	6.7	197		
			z=20	Aceanthrenes	2.6	227		
			z=22	Pyrenes	4.7	223		
			z=24	Chrysenes	0.9	246		
			z=26	Benzofluoranthenes	0.3	276		
			z=28	Benzopyrenes	0.6	280		
			z=30	Dibenzanthracenes	<0.1	292		
			z=32	Benzoperylenes	T	ND		
			z=34	Dibenzopyrenes	T	ND		
			z=36	Coronenes	T	ND		
				Total Aromatic Hydrocarbons	53.8	186		
Hydrotreated middle distillates (jet/diesel/ other light fuel oil)		NA	--				--	--
Hydrotreated middle distillate blends (light fuel oils)		NA	--				--	--

Explanatory Notes

*All values by MS analyses

†The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

‡Values by GC/MS; compounds listed are the twenty most prevalent compounds present in the sample.

§See General Comments section, Note 4, for summary of operating conditions used.

#See General Comments section, Note 5, for summary of operating conditions used.

**From the molecular formula: C_nH_{2n+x}

††Suggested compound types; multiheteroaromatics normalized out of results.

Table 298. Nitrogen-, Oxygen-, and Sulfur-Containing Compound*

			Value			
Material	**Process**	**Coal Type**	**Compound Class**	**Wt %**	**Sample Description/Source**	**Reference**
Coal raw middle distillates	SRC-I†	KY No. 9	a C3-Alkyl-Phenol	2.0	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1897CB)	82
			a C5-Alkyl-Biphenol	1.6		
			3- & 4-Methyl-Phenol	1.4		
			Total Phenols	15.87		
		KY No. 9	3- & 4-Methyl-Phenols	1.9	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB)	82
			an Ethyl-Methyl-Phenol	1.6		
			Total Phenols	12.58		
			Dibenzothiophene	1.3		
		KY No. 9	Total Phenols	7.56	Wilsonville pilot plant Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1)	82
		KY No. 9	Total Phenols	1.91	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)	82
		KY No. 9	Phenol	0.38	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1899CB). Caustic extraction with 20% NaOH, (1/1-v/v);GC analysis of extract	82
			O-Cresol	0.10		
			m&p-Cresol	1.21		
			2,6-Xylenol	0.06		
			O-Ethylphenol	0.16		
			2,4- & 2,5-Xylenol	0.94		
			m&p-Ethylphenol	1.91		
			2,3-Xylenol	0.15		
			3,4-Xylenol	0.21		
			Heavier Phenolics	7.47		
			Total	12.59		
		KY No. 9	Phenol	ND	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1911CB). Caustic extraction with 20% NaOH, (1/1-v/v); GC analysis of extract	82
			O-Cresol	0.08		
			m&p-Cresol	1.24		
			2,6-Xylenol	0.09		
			O-Ethylphenol	0.17		
			2,4- & 2,5-Xylenol	0.18		
			m&p-Ethylphenol	1.47		
			2,3-Xylenol	0.13		
			3,4-Xylenol	0.18		
			Heavier phenolics	14.74		
			Total	18.91		

(Continued)

Table 298 (Continued)

Material	Process	Coal Type	Value Compound Class	Wt %	Sample Description/Source	Reference
Coal raw middle distillates	SRC-I†	KY No. 9	Phenol	ND	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1). Caustic extraction with 20% NaOH, 1/1-v/v, GC analysis of extract	82
			O-Cresol			
			m&p-Cresol			
			2,6-Xylenol			
			O-Ethylphenol			
			2,4- & 2,5-Xylenol			
			m&p Ethylphenol			
			2,3-Xylenol			
			3,4-Xylenol			
			Heavier phenolics			
		KY No. 9	Phenol	ND	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB). Caustic extraction with 20% NaOH, 1/1-v/v, GC analysis of extract	82
			O-Cresol	ND		
			m&p-Cresol	ND		
			2,6-Xylenol	ND		
			O-Ethylphenol	ND		
			2,4- & 2,5-Xylenol	ND		
			m&p Ethylphenol	ND		
			2,3-Xylenol	ND		
			3,4-Xylenol	ND		
			Heavier phenolics	0.37		
			Total	0.37		
	H-Coal	IL No. 6		Caustic Extract from Atmospheric Overhead Product‡	380-650°F distillate from PDU Run 5, Run 130-82, Period 29§	111
			Phenols			
			Yields, W % of Dry Coal			
			7 Mesh Components	0.02		
			Phenol	0.55		
			O-Cresol	0.33		
			m&p-Cresol	0.85		
			O-Ethylphenol	0.09		
			2,6-Xylenol	0.04		
			m&p-Ethylphenol	0.39		
			Unknown	0.25		
			2,3- & 4,5-Xylenol	0.24		
			3,4-Xylenol	0.06		
			Heavier Components	1.20	(17 compounds)	
			Total	4.0		

(Continued)

Table 298 (Continued)

Material	Process	Coal Type	Value Compound Class	Wt %	Sample Description/Source	Reference
Coal raw middle distillates	H-Coal	Wyodak	Phenols	5.0	360-650°F distillate from PDU Run 6, Run 130-83, Period 17[¶]	112
		IL No. 6	Phenols	17.0	450-650°F distillate from PDU, syncrude mode	98
		IL No. 6	X Class**		PDU, syncrude mode	109
			Aromatic Sulfur Types			
			-10 Benzothiophenes	0.1[††]		
			-16 Dibenzothiophenes	0.0		
			-22 Naphthobenzothiophene	0.0		
			Unidentified	0.0		
		Wyodak	X Class[§]		PDU, syncrude mode	109
			Aromatic Sulfur Types			
			-10 Benzothiophenes	0.1[††]		
			-16 Dibenzothiophenes	0.0		
			-22 Naphthobenzothiophene	0.0		
			Unidentified	0.0		
		W.KY 11	X Class [§]		PDU, syncrude mode	109
			Aromatic Sulfur Types			
			-10 Benzothiophenes	0.2[††]		
			-16 Dibenzothiophenes	0.1		
			-22 Naphthobenzothiophene	0.0		
			Unidentified	0.0		

(Continued)

Table 298 (Continued)

Material	Process	Coal Type	z No.	Aromatic Oxygens Compound Types, % $C_nH_{2n-z}O$[††]	(wt %)	Sample Description/Source	Reference
Coal raw middle distillate blends (light fuel oils)	SRC-II	NA	z=6	Phenols	14.4	2.9/1 medium/heavy distillate blend, UOP Sample No. 3777-6	113
			z=8	Naphthenophenols	5.7		
			z=10	Benzofurans	0.6		
			z=12	Naphthols	<0.1		
			z=14	Naphthenonaphthols	3.2		
			z=16	Dibenzofurans	2.6		
			z=18	Hydroxyanthracenes	0.3		
			z=20	Hydroxynaphthenoanthracenes	0.2		
			z=22	Hydroxypyrenes	0.5		
			z=24	Hydroxychrysenes	T[##]		
				Total	27.6		
			z No.	Aromatic Dioxygenates Compound Types, $C_nH_{2n-z}O_2$[††]			
			z=6	Hydroxyphenols	0.3[§§]		
			z=14	Hydroxynaphthenonaphthols	0.7[§§]		
			z=16	Hydroxydibenzofurans	0.5[§§]		
			z=18	Dihydroxyanthracenes	<0.1[§§]		
			z=20	Dihydroxynaphthenonanthracenes	<0.1[§§]		
				Total	1.7		
			z No.	Aromatic Trioxygenates Compound Types, $C_nH_{2n-z}O_3$[††]			
			z=6	Dihydroxyphenols	<0.1[§§]		
			z=12	Dihydroxynaphthol	0.2[§§]		
			z=14	Dihydroxynaphthenonaphthols	T [§§]		
				Total	0.3[*]		

Table 298 (Continued)

Material	Process	Coal Type	z No.	Aromatic Nitrogens Compound Types, $C_nH_{2n-z}N$††	Wt %	Average Molecular Weight	Sample Description/Source	Reference
Coal raw middle distillate blends (light fuel oils)	SRC-II	NA	z=5N	Pyridines	1.5	130		
			z=7N	Naphthenopyridines	1.1	153		
			z=9N	Indoles	0.6	152		
			z=11N	Quinolines	1.3	156		
			z=13N	Naphthenoquinolines	0.6	198		
			z=15N	Carbazoles	0.6	191		
			z=17N	Acridines	0.6	202		
			z=19N	Naphthenobenzoquinolines	<0.1	222		
			z=21N	Benzocarbazoles	0.5	228		
			z=23N	Benzacridines	<0.1	254		
			z=25N	Naphthenobenzacridines	T	NA		
			z=27N	Dibenzocarbazoles	T	NA		
				Total	7.0	167		
			z No.	Aromatic Sulfurs Compound Types, $C_nH_{2n-z}S$††	Wt %‡			
			z=6S	Benzenethiols	T	NA		
			z=8S	Dihydrothionaphthenes	0.2	199		
			z=10S	Benzothiophenes	<0.1	172		
			z=12S	Naphthenobenzothiophenes	T	NA		
			z=14S	Indenothiophenes	T	NA		
			z=16S	Dibenzothiophenes	0.6	205		
			z=18S	Acenaphthenothiophenes	<0.1	239		
			z=20S	Fluorenothiophenes	T	NA		
			z=22S	Tribenzothiophenes	<0.1	250		
			z=24S	Acephenanthrylenethiophenes	T	NA		
			z=26S	Pyrenothiophenes	T	NA		
				Total	1.2	209		

(Continued)

Table 298 (Concluded)

Material	Process	Coal Type	Value Compound Class	Wt %	Sample Description/Source	Reference
Coal raw middle distillate blends (light fuel oils)	SRC-II	NA	Phenol	2.0	Medium and heavy distillate blend, before water wash, Chevron Sample No. SGQ-7559	115
		NA	Phenol	1.7	Medium and heavy distillate blend, after water wash, Chevron Sample No. WOW-4551	115
Hydro-treated middle distillates (jet/diesel/other light fuel oil)		NA	--	--	--	--
Hydro-treated middle distillate blends (light fuel oils)		NA	--	--	--	--

Explanatory Notes

[*] All values by MS analysis.

[†] The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 73.3/22.2/4.5 weight percent blend of middle distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

[‡] 9.5 V% (11.0 wt %) of atmospheric still overhead.

[§] See General Comments section, Note 4, for summary of operating conditions used.

[#] See General Comments section, Note 5, for summary of operating conditions used.

[**] From the molecular formula: C_{2n+x}.

[††] Analysis by GC/MS.

[‡‡] Suggested compound types. Multiheteroaromatics normalized.

[§§] Estimates due to lack of sensitivity data.

[##] T = trace, $\leq$ 0.05%

Table 299. Compound Class Analysis Obtained by Solvent Fractionation (wt %)*

Material	Process	Coal Type	Volatiles	Ether In-solubles	Ether Soluble Acids	Insoluble Acids	Ether Soluble Bases	Insoluble Bases	Neutral Saturates	Neutral Aromatics	Neutral Poly-Aromatics	Neutral Polars	Total	Neutral Fraction			Sample Description/Source	Reference
														Experimental	Summation	Recovery		
Coal raw middle distillates	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Coal raw middle distillate blends (light fuel oil)	SRC-II	NA	3.0	NA	3.8	0.1	5.6	0.1	5.0	59.2	7.3	0.2	84.2	78.5	71.5	91.1	Ft. Lewis pilot plant, fuel oil blend, DOE Sample No. 1710	136
Hydro-treated middle distillates (jet/diesel/other light fuel oil)	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hydro-treated middle distillate blends (light fuel oils)	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Explanatory Note

*This solvent fractionation scheme involves a combination of liquid-liquid extractions and column chromatography (Reference 136).

Table 300. General Physical and Chemical Properties of Various Distillation Fractions of Coal Raw Middle Distillates

Material	Process	Coal Type	Distillation Fraction No.	Vapor Temperature, °F			Specific Gravity 60°F/60°F	Pour Point °F	Molecular Weight (cryoscopic)	Sample Description/ Source	Reference
				5% wt. off	50% wt. off	95% wt. off					
Coal raw middle distillates	SRC-II	Powhattan No. 5	7	419	428	456.8	0.9622	<-65.2	140	PDU P-99	110
			8	476.6	485.6	519.8	0.9761	-45.4	154		
			8HC*	478.4†	482	485.6†	0.9718	NA	NA		
			9	516.2	527	548.6	0.9802	-29.2	NA		
			10	537.8	572	599	0.9972	-0.4	NA		
			11	618.8	647.6	701.6	1.0392	41	NA		
			11HC*	638.6†	649.4	662†	1.0359	NA	NA		
Coal raw middle distillate blends (light fuel oils)	NA	--			--					--	--
Hydro-treated middle distillates (jet/diesel/ other light fuel oil)	NA	--			--					--	--
Hydro-treated middle distillate blends (light fuel oils)	NA	--			--					--	--

Explanatory Notes

*Heart cut from secondary fractionation

†Full boiling range

Table 301. Elemental Composition Data for Various Distillation Fractions of Coal Raw Middle Distillates

Material	Process	Coal Type	Distillation Fraction No.	50%, wt. Off Temperature, °F	Elemental Composition, Wt % (Dry Basis)					Sample Description/Source	Reference
					C	H	N	O	S		
Coal raw middle distillates	SRC-II	Powhattan No. 5	7	428	84.61	9.35	0.72	5.19	0.13	PDU P-99	110
			8	485.6	86.12	9.25	1.17	3.15	0.31		
			9	527	87.35	9.64	0.85	1.95	0.21		
			10	572	88.33	8.96	0.76	1.78	0.17		
			11	647.6	88.84	8.13	1.10	1.59	0.34		
Coal raw middle distillate blends (light fuel oil)	NA	--			--					--	--
Hydro-treated middle distillates (jet/diesel/other light fuel oil)	NA	--			--					--	--
Hydro-treated middle distillate blends (light fuel oils)	NA	--			--					--	--

Table 302. General Physical and Chemical Properties of Secondary Coal-Derived Middle Distillates and Jet/Diesel Fuels

Material	Process	Coal Type	Parameter	Value				Sample Description/Source	Reference
				Period 1*	Period 2*	Period 3*	Period 4*		
Middle distillate from hydrotreated whole coal liquid	SRC-II	KY No. 9 and 14, Il No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	Gravity, °API	34.6	28.5	27.3	33.3	Ft. Lewis pilot plant; 300-550°F product from hydrotreating of SRC-II whole coal liquid with ICR 106 catalyst; Run No. 76-165. Operating conditions: Period 1, Run Hours 251-275, 750°F catalyst temperature 0.55 LHSV, 2300 psia H_2; Period 2, Run Hours 539-563, 750°F catalyst temperature, 1.51 LHSV, 2300 psia H_2; Period 3, Run Hours 2339-2351, 768°F catalyst temperature, 1.52 LHSV, 2300 psia H_2; Period 4, Run Hours 2709-2733, 776°F catalyst temperature, 0.49 LHSV, 2300 psia H_2.	86
			Aniline Point, °F	122.3	60.3	41.8	110.2		
			Smoke Point, mm	22	11	11	20		
			Freeze Point, °F	<-94	-76	-76	--81		
			TBP Distillation, °F (Simulated by Chromatography)						
			St/5	266/304	264/313	NA	277/312		
			10/30	316/365	332/382	NA	329/373		
			50	404	419	NA	403		
			70/90	451/504	460/510	NA	442/497		
			95/99	520/560	526/550	NA	516/542		
			ASTM D 86 Distillation, °F						
			St/5	342/357	340/358	346/353	344/356		
			10/30	363/380	366/389	358/394	362/378		
			50	399	412	415	398		
			70/90	427/472	440/478	441/478	425/474		
			95/EP	488/531	494/531	491/516	495/533		
			% Overhead	99	99	99	99		
			Viscosity						
			cSt at -40°F	12.79	13.17	NA	11.92		
			cSt at -4°F	NA	NA	NA	NA		
			cSt at 100°F	NA	1.591	NA	1.640		
			Density at 70°C	0.8130	0.8443	0.8507	0.8182		
			Molecular Weight	155	154	152	146		
			Refractive Index at 80°C	1.4362	1.4611	1.4668	1.4407		
			Existent Gum, ppm	NA	NA	NA	0		
			Flash Point, D 56, °F	132	142	142	134		
			Neutralization No. (acid), mg/g	0.019	0.034	0.05	0.05		

(Continued)

Table 302 (Continued)

Material	Process	Coal Type	Chevron Sample No.	Value				Sample Description/Source	Reference
				SGQ 6547	SGQ 6581	SGQ 6588			
Middle distillate from hydrotreated whole coal liquid	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	Gravity, °API	27.5	26.5	24.6		Ft. Lewis pilot plant; 300-550°F product from partial hydrotreating of SRC-II whole coal liquid	86
			Aniline Point, °F	48.4	33.3	<22			
			Smoke Point, mm	11	9	8			
			Freeze Point, °F	-71	NA	NA			
			TBP Distillation (Simulated by Chromatography)						
			St/5	222/305	242/309	239/312			
			10/30	328/386	332/393	335/399			
			50	423	429	429			
			70/90	462/509	467/516	464/509			
			95/99	525/549	533/554	525/549			
			ASTM D 86 Distillation, °F						
			St/5	360/365	340/358	NA			
			10/30	368/380	368/395				
			50	402	420				
			70/90	434/474	444/483				
			95/EP	482/520	498/530				
			% Overhead	98.5	98.5				
			Viscosity						
			At -40°F, cSt	12.59	NA	16.12			
			At 130°F, cSt	1.219	1.229	1.250			
				Period 1*	Period 2*	Period 3*	Period 4*		
Coal-derived jet fuel from hydrotreated whole coal liquid	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	API Gravity	32.0	33.4	38.7	40.3	Ft. Lewis pilot plant; from hydrofinishing of Chevron Sample No. SGQ 6547 (300-550°F produuct from partial hydrotreating of SRC-II whole coal liquid) with ICR 113 catalyst. Operating conditions for Periods 1 through 4, respectively: Run Hours, 402-414 426-438, 450-462, 462-486; average catalyst temperature, °F, 701, 700, 750, 751; LHSV, 2.03, 1.02, 1.00, 1.01; total pressure psig, 1350, 1346, 1703, 1700; H_2 mean pressure, psia, 1215, 1209, 1521, 1518.	86
			Aniline Point, °F	69.2	78.0	93.2	93.5		
			Smoke Point, mm	13	15	17	17		
			Pour Point, °F	-79	-76	-81	-83		
			TBP Distillation (Simulated by Chromatography)						
			IBP/5	32/235°F	85/232°F	38/140°F	37/99°F		
			10/30	295/364°F	286/360°F	174/296°F	168/286°F		
			50	405°F	401°F	355°F	348°F		
			70/90	442/493°F	437/489°F	408/474°F	402/467°F		
			95/99	515/551°F	510/552°F	499/552°F	494/547°F		
			ASTM D 86 Distillation						
			IBP/5	212/278	NA	NA	NA		
			10/30	312/364	NA	NA	NA		
			50	392	NA	NA	NA		
			70/90	420/464	NA	NA	NA		
			95/EP	483/510	NA	NA	NA		

(Continued)

Table 302 (Continued)

				Value						
Material	**Process**	**Coal Type**	**Parameter**	**Period 1***	**Period 2***	**Period 3***	**Period 4***	**Period 5°**	**Sample Description/Source**	**Reference**
Coal-derived jet fuel from hydro-treated whole coal liquid	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Black-ville No. 2 Mine)	API Gravity	33.9	29.9	30.4	31.4	34.1	Ft. Lewis pilot plant; from hydrofinishing of Chevron Sample No. SGQ 6547 (300-550°F product from partial hydrotreating of SRC-II whole coal liquid) with ICR 113 catalyst. Operating conditions for Periods 1 through 5 respectively: Run Hours, 498-510, 522-524, 546-558, 570-582, 594-606; average catalyst temperature, °F, 750, 701, 725, 750, 775; LHSV, 1.00, 0.99, 1.03, 1.07, 0.98; total pressure psig, 1713, 2096, 2099, 2050, 2099; H_2 mean pressure psig, 1535, 1912, 1887, 1834, 1874.	86
			Aniline Point, °F	74.3	62.4	66.8	69.3	79.7		
			Smoke Point, mm	12	12	12	12	13		
			Freeze Point, °F	-76	-66	-67	-76	-81		
			TBP Distillation (Simulated by Chromatography)							
			IBP/5	42/169°F	45/285°F	46/281°F	30/258°F	19/208°F		
			10/30	221/323°F	318/373°F	316/371°F	306/367°F	277/353°F		
			50	378°F	409°F	408°F	406°F	392°F		
			70/90	432/495°F	448/500°F	446/499°F	444/496°F	428/485°F		
			95/99	518/567°F	520/554°F	520/554°F	518/555°F	509/530°F		

			Period 1*	**Period 2***	**Period 3***	**Period 4***	**Period 5***	**Period 6***		
	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Black-ville No. 2 Mine)	API Gravity	39.4	39.3	36.5	34.1	32.5	33.1	Ft. Lewis pilot plant; from hydrofinishing of Chevron Sample No. SGQ 6581 (300-650°F product from partial hydrotreating of SRC-II whole coal liquid) with ICR 106 catalyst. Operating conditions for Periods 1 through 6, respectively: Run Hours 92-104, 104-128, 140-152, 164-176, 188-200, 212-224; average catalyst temperature, °F, 724, 727, 727, 704, 704, 728: LHSV, 1.02, 1.00, 2.00, 1.99, 1.91, 2.00; total pressure psig, 1699, 1697, 1696, 1694, 1379, 1399; H_2 mean pressure, psig, 1528, 1528, 1527, 1535, 1250, 1251.	86
		Aniline Point, °F	NA	122.2	110.9	102.0	86.2	84.4		
		Smoke Point, mm	24	23	22	17	14	14		
		Freeze Point, °F	-81	-90	-84	-77	-74	-72		
		TBP Distillation (Simulated by Chromatography)								
		IBP/5	50/192°F	30/200°F	31/228°F	45/270°F	42/272°F	28/233°F		
		10/30	248/340°F	261/344°F	291/358°F	309/367°F	310/368°F	293/361°F		
		50	376°F	376°F	388°F	396°F	402°F	395°F		
		70/90	406/462°F	407/465°F	419/476°F	432/488°F	439/491°F	431/489°F		
		95/99	486/530°F	490/536°F	500/546°F	508/552°F	512/556°F	509/556°F		

(Continued)

Table 302 (Concluded)

Material	Process	Coal Type	Value		Sample Description/Source	Reference
Coal-derived jet fuel from hydrotreated whole coal liquid	SRC-II	Pitt-Seams WV (Blackville No. 2 Mine)	API Gravity	36.3	From single stage hydrotreating of SRC-II syncrude using ICR-113 catalyst, operating conditions: catalyst temperature, 750°F, LHSV, 0.5, H_2 partial pressure, 2306 psig.	88
			Aniline Point, °F	>100		
			Copper Strip Corrosion	No. 1		
			Smoke Point, mm	22		
			Freeze Point, °F	-75		
			Existent Gum, ppm	2		
			Thermal Stability	No. 1		

Explanatory Notes

*Each period refers to a run time having a characteristic set of operating conditions.

Table 303. General Physical and Chemical Properties of Jet/Diesel/Heating Fuels from Various Distillation Cuts of H-Coal Syncrudes

Part A. From Severe Hydrotreatment over Fresh ICR 106 Catalyst for Jet/Diesel Fuel Production (Reference 95)

Coal Type	Illinois H-Coal		Rerun Illinois H-Coal		Wyodak H-Coal		
Operating Conditions:							
Catalyst Temperature	750		748		752		
LHSV	0.5		1.5		1.0		
Run (Hours)	76-171 (222-246)		76-173 (463-473)		76-173 (331-355)		
Boiling Range, °F	250+	300	350+	250+	250+	300+	350+
Gravity, °API	36.3	34.3	32.4	37.8	39.7	37.3	35.4
Aniline Point, °F	128.2	130.1	132.2	121.8	131.7	134.0	137.5
Refractive Index at 20°C	1.4584	1.4631	1.4677		1.4517†	NA	NA
Density at 20°C	0.8414	0.8511	0.8509		0.8252†	NA	NA
Molecular Weight	167	169	105		154†	NA	NA
Smoke Point, mm	23	22	21	21	21	21	NA
Cetane No.	NA	NA	42.5†	NA	NA	NA	NA
Freeze Point, °F	-53	-45	-41	-51	-31	NA	NA
Pour Point, °F	NA	NA	-60†	NA	-60	-60	NA
Cloud Point, °F	NA	-70†	-50†	NA	NA	-20	NA
Flash (Tag Closed), °F	108	133	NA	NA	NA	NA	NA
Flash (P-M), °F	116†	NA	NA	NA	NA	NA	NA
Cu Strip Corrosion	1A†	NA	1A†	NA	1A†	NA	NA
Viscosity, cSt							
At -4°F	6.478	7.434	9.860	4.707	4.549	6.153	8.184
At 100°F	1.678	1.898	2.206†	1.523	1.441	1.701	1.999
Distillation, LV %, °F	D 86	TBP*	TBP*	TBP*	D 86	D 86	TBP*
St/5	298/316	286/311	314/355	211/257	295/313	344/352	313/352
10/30	330/367	430/370	365/394	273/338	320/344	358/380	362/388
50	402	407	434	382	378	400	418
70/90	443/511	468/559	482/547	428/496	420/490	433/499	463/527
95/EP	544/589	612/756	584/666	519/575	526/594	532/602	571/677

(Continued)

Table 303 (Continued)

Part B. From Severe Hydrotreatment over Aged ICR 106 Catalyst for Jet/Diesel Fuel Production (Reference 95)

Coal Type	Illinois H-Coal		Rerun Illinois H-Coal	Wyodak H-Coal		Rerun Wyodak H-Coal		
Operating Conditions:								
	774		802	802		803		
Catalyst Temperature	0.5		1.5	1.0		1.5		
LHSV	76-171		76-174	76-174		76-174		
Run (Hours)	(3191-3215)		(364-376)	(208-232)		(604-616)		
Boiling Range, °F	250+	350+†	250+	250-260	250+†	250+	300+	350+
Gravity, °API	34.5	29.1	38.7	38.0	39.4	39.3	37.2	35.3
Aniline Point, °F	116.8	109.8	117.4	115.2	111.7	118.4	120.3	122.1
Refractive Index at 20°C	1.4646	NA	NA	NA	1.4591	NA	NA	NA
Density at 20°C	0.8487	NA	NA	NA	0.8327	NA	NA	NA
Molecular Weight	157	NA	NA	NA	155	NA	NA	NA
Smoke Point, mm	19	NA	19	19	18	20	NA	NA
Cetane No.	39.3†	37.7	35.8	NA	NA	NA	NA	NA
Freeze Point, °F	<-94	NA	-68	-61	-27	<-94	NA	NA
Pour Point, °F	NA	NA	<-80	<-80	<-80	NA	<-80	NA
Cloud Point, °F	NA	-54	NA	-80	+10	NA	<-80	NA
Cu Strip Corrosion	NA	1A	NA	NA	1B	NA	NA	NA
Viscosity, cSt								
At -4°F	5.656		4.375	4.186	NA	4.019	5.169	6.770
At 100°F	1.665		1.570	1.352	1.342	1.310	1.536	1.780
Distillation, LV %, °F	D 86	D 86	D 86	D 86	D 86			TBP*
St/5	291/312	400/400	296/313	298/300	287/305	NA	NA	313/348
10/30	326/361	400/417	318/348	318/342	313/340			358/385
50	404	440	379	377	374			411
70/90	450/526	492/551	415/471	420/476	417/482			449/505
95/EP	581/596	600/646	496/530	500/546	518/591			532/589

(Continued)

Table 303 (Continued)

Part C. From Moderate Hydrotreatment over Fresh ICR-106 and 113 Catalysts for Heating Fuels Production (Reference 95)

Coal Type/Catalyst	Illinois H-Coal/ICR 106			Wyodak H-Coal/ ICR 113
Operating Conditions:				
Catalyst Temperature, °F	775			747
LHSV	1.5			1.5
Run (Hours)	(1967-1991)			(1366-1390)
Boiling Range, °F	250+	300+	350+	250+
Gravity, °API	27.7	25.4	23.0	32.7
Aniline Point, °F	49.2	46.0	40.8	72.3
Refractive Index at 20°C	NA	NA	1.5105	NA
Density at 20°C	NA	NA	0.9157	0.8656
Cloud Point, °F	-50	-38	-58	+20
Pour Point, °F	NA	NA	NA	-45
Freeze Point, °F	NA	NA	NA	+19
Flash Point (P-M), °F	116	148	176	114
Cu Strip Corrosion	1A	NA	NA	1A
Viscosity at 1000°F, cSt	1.646	1.969	2.294	1.500
D-86 Distillation, LV %, °F				
St/5	311/324	360/366	397/413	299/316
10/30	339/381	376/400	418/439	325/357
50	430	441	466	401
70/90	483/560	487/562	508/586	448/527
95/EP	601/664	605/685	642/667	573/659

(Continued)

Table 303 (Concluded)

Part D. From Moderate Hydrotreatment over Fresh ICR 106 Catalyst for Fuel Oil Production (Reference 95)

Operating Conditions	2500 psig			2000 psig			2000 psig		
Run (Hours)	76-171 (654-678)			76-171 (1535-1559)			76-171 (1967-1991)		
Catalyst Temp., °F	750			750			775		
LHSV	1.5			1.5			1.5		
Total Pressure, psig	2493			2001			2073		
H2 Pressure, psia	2231			1778			1859		
Boiling Range, °F	250+	300+	350+	250+	300+	350+	250+	300+	350+
Gravity, °API	28.1	25.8	23.6	26.8	24.6	22.2	27.7	25.4	23.0
Aniline Point, °F	51.4	46.0	42.8	45.1	39.8	33.3	49.2	46.0	40.8
Refractive Index, 20°C	1.4599	1.5026	1.5096	1.4968	NA	1.5130	NA	NA	1.5105
Density, 20°C	0.8455	0.9029	0.9151	0.8920	NA	0.9136	NA	NA	0.9157
Molecular Weight	170	165	173	162		171			190
Cloud Point, °F	NA	NA	NA	NA	NA	NA	-50	-38	-58
Pour Point, °F	<-80	-65	-55	<-80	<-80	-70	NA	NA	NA
Freeze Point, °F	<-94	<-94	-80	NA	NA	NA	NA	NA	NA
Smoke Point, mm	7	8	7	9	10	9	NA	NA	NA
Flash Point (P-M), °F	112	142	152	104	130	165	116	148	176
Cu Strip Corrosion	NA	NA	NA	NA	NA	NA	1A	NA	NA
Viscosity, cSt									
at -4°F	12.67	21.64	NA	NA	NA	30.06	NA	NA	NA
at 100°F	1.767	2.085	2.308	NA	NA	2.448	NA	NA	NA
Distillation, LV %, °F	D 86	D 86	TBP*	D 86	D 86	D 86	D 86	D 86	D 86
St/5	294/315	342/362	325/364	290/310	340/352	380/393	311/324	360/366	397/413
10/30	334/380	373/407	377/422	328/374	360/400	403/429	339/381	376/400	418/439
50	429	445	466	426	441	458	430	441	466
70/90	477/562	492/568	518/603	478/573	489/574	502/580	483/560	487/562	508/586
95/EP	593/675	618/662	654/755	NA	NA	NA	601/664	605/685	642/667

Explanatory Notes

*Simulated by chromatography.

†Measured at other hours but at these conditions.

Table 304. Elemental Composition of Secondary Coal-Derived Middle Distillates and Jet/Diesel Fuels

Material	Process	Coal Type	Parameter	Value (wt %) Period 1*	Period 2*	Period 3*	Period 4*	Sample Description/Source	Reference
Middle distillate from hydrotreated whole coal liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	Nitrogen	NA	.0019	NA	NA	Ft. Lewis pilot plant; 300-550°F product from hydrotreating of SRC-II whole coal liquid with ICR 106 catalyst; Run No. 76-165. Operating conditions: Period 1, Run Hours 251-275, 750°F catalyst temperature, 0.55 LHSV, 2300 psia H_2; Period 2, Run Hours 539-563, 750°F catalyst temperature, 1.51 LHSV, 2300 psia H_2; Period 3, Run Hours 2339-2351, 768°F catalyst temperature, 1.52 LHSV, 2300 psia H_2; Period 4, Run Hours 2709-2733, 776°F catalyst temperature, 0.49 LHSV, 2300 psia H_2.	86
			Oxygen	NA	.0970	.14	NA		
	Chevron Sample No.			SGQ 6547	SGQ6581		SGQ6588	Ft. Lewis pilot plant; 300-550°F product from partial hydrotreating of SRC-II whole coal liquid	86
	Sulfur, ppm			NA	.00029		.00074		
	Total Nitrogen			.0012	.0173		.0838		
	Basic Nitrogen			NA	.0185		NA		
	Oxygen			.0600	.2400		.07400		
	Hydrogen (wt %)			NA	.001141		NA		
Coal-derived jet fuel from hydrotreated whole coal liquid	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	Sulfur	0.00018	NA	NA	NA	Ft. Lewis pilot plant; from hydrofinishing of Chevron Sample No. SGQ 6547 (300-550°F product from partial hydrotreating of SRC-II whole coal liquid) with ICR 113 catalyst. Operating conditions for Periods 1 through 4, respectively: Run Hours, 402-414, 426-438, 450-462, 462-486; average catalyst temperature, °F, LHSV, 2.03, 1.02, 1.00, 1.01; total pressure psig, 1350, 1346, 1703, 1700; H_2 mean pressure, psia, 1215, 1209, 1521, 1518.	86
			Nitrogen	0.000028	0.000022	0.000019	0.000021		
			Oxygen	0.0110	0.0090	0.0090	0.0170		

Table 304 (Concluded)

Material	Process	Coal Type	Parameter	Value (wt %)						Sample Description/Source	Reference
				Period 1*	Period 2*	Period 3*	Period 4*	Period 5*			
Coal-derived jet fuel from hydro-treated whole coal liquid	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Black-ville No. 2 Mine)	Nitrogen	0.000026	0.000020	0.000018	0.000035	NA		Ft. Lewis pilot plant; from hydrofinishing of Chevron Sample No. SGQ 6547 (300-550°F product from partial hydrotreating of SRC-II whole coal liquid) with ICR 113 catalyst. Operating conditions for Periods 1 through 5 respectively: Run Hours, 498-510, 522-524, 546-558, 570-582, 594-606; average catalyst temperature, °F, 750, 701, 725, 750, 775; LHSV, 1.00, 0.99, 1.03, 1.07, 0.98; total pressure psig, 1713, 2096, 2099, 2050, 2099; H_2 mean pressure psig, 1535, 1912, 1887, 1834, 1874.	86
			Oxygen	0.0190	NA	NA	NA	NA			
				Period 1*	Period 2*	Period 3*	Period 4*	Period 5*	Period 6*		
		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Black-ville No. 2 Mine)	Nitrogen	0.000014	0.000044	0.000015	0.000012	0.000016	0.000015	Ft. Lewis pilot plant; from hydrofinishing of Chevron Sample No. SGQ 6581 (300-550°F product from partial hydrotreating of SRC-II whole coal liquid) with ICR 106 catalyst. Operating conditions for Periods 1 through 6 respectively: Run Hours, 92-104, 104-128, 140-152, 164-176, 188-200, 212-224; average catalyst temperature, °F, 724, 727, 727, 704, 704, 728; LHSV, 1.02, 1.00, 2.00, 1.99, 1.91, 2.00; total pressure psig, 1699, 1697, 1696, 1694, 1379, 1399; H_2 mean pressure psig, 1528, 1528, 1527, 1535, 1250, 1251.	86

Explanatory Note

*Each period refers to a run having a characteristic set of operating conditions.

Table 305. Elemental Composition of Jet/Diesel/Heating Fuels From Various Distillation Cuts of H-Coal Syncrudes

Part A. From Severe Hydrotreatement over Fresh ICR 106 Catalyst for Jet/Diesel Fuel Production (Reference 95)

Coal Type	Illinois H-Coal		
Operating conditions:			
Catalyst temperature, °F	750		
LHSV	0.5		
Run (Hours)	76-171 (222-246)		
Boiling Range, °F	250^+	300^+	350^+
Sulfur, wt %	.0008	.0006	.00045
Nitrogen, wt %	NA	NA	NA
Oxygen, wt %	NA	NA	NA

Part B. From Severe Hydrotreatment over Aged ICR 106 Catalyst for Jet/Diesel Fuel Production (Reference 95)

Coal Type	Wyodak		Rerun Wyodak		
Operating conditions:					
Catalyst temperature, °F	802		803		
LHSV	1.0		1.5		
Run (Hours)	76-174 (208-232)		76-174 (604-616)		
Boiling Range, °F	250-600	250^{+*}	250^+	300^+	350^+
Sulfur, wt %	.000274	.00049	.000061	.000045	.000053

Part C. From Moderate Hydrotreatment over Fresh ICR 106 and 113 Catalysts for Heating Fuels Production (Reference 95)

Coal Type/catalyst	Illinois H-Coal/ICR 106			Wyodak H-Coal/ICR 1B
Operating conditions:				
Catalyst temperature, °F	775			747
LHSV	1.5			1.5
Run (Hours)	76-171 (1967-1991)			66-203 (1366-1390)
Boiling Range, °F	250^+	300^+	350^+	250^+
Sulfur, wt %	NA	NA	NA	.000076
Nitrogen, wt %	NA	.0018	NA	.00066

Part D. From Moderate Hydrotreament over Fresh ICR 106 Catalyst for Fuel Oil Production (Reference 95)

	2500 psig			2000 psig			2000 psig		
Coal Type	IL. No. 6			IL No. 6			IL. No. 6		
Operating conditions:									
Run (Hours)	76-171 (654-678)			76-171 (1535-1559)			76-171 (1967-1991)		
Catalyst Temperature °F	750			750			775		
LHSV	1.5			1.5			1.5		
Total Pressure, psig	2493			2001			2073		
H_2 Pressure, psia	2231			1773			1859		
Boiling Range, °F	250^+	300^+	350^+	250	300	350	250	300	350
Sulfur, wt %	.00020	.00040	.00020	.00016	.00020	NA	NA	NA	NA
Oxygen, wt %	.0590	.0650	.0440	.1400	.1300	.1400	NA	NA	NA
Nitrogen, wt %	NA	NA	NA	NA	NA	NA	NA	NA	NA

Explanatory Note:

*Measured at other hours but these conditions.

Table 306. Hydrocarbon Compound Class Properties of Secondary Coal-Derived Middle Distillates and Jet/Diesel Fuels

Material	Process	Coal Type	Parameter	Value (LV %) Period 1*	Period 2*	Period 3*	Period 4*	Sample Description/Source	Reference
Middle distillate from hydrotreated whole coal liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	Group Type,					Ft. Lewis pilot plant; 300-550°F product from hydrotreating of SRC-II whole coal liquids with ICR 106 catalyst; Run No. 76-165. Operating conditions: Period 1, Run Hours 251-275, 750°F catalyst temperature, 0.55 LHSV, 2300 psia H_2; Period 2, Run Hours 539-563, 750°F catalyst temperature, 0.51 LHSV, 2300 psia H_2; Period 3, Run Hours 2339-2351, 768°F catalyst temperature, 1.52 LHSV, 2300 psia H_2; Period 4, Run Hours 2709-2733, 776°F catalyst temperature, 0.49 LHSV, 2300 psia H_2.	86
			Saturates	95.9	51.1	41.0	85.0		
			Aromatics	4.0	48.8	59.0	15.0		
	Chevron Sample No.			SGQ 6547	SGQ6581		SGQ6588	Ft. Lewis pilot plant; 300-550°F product from partial hydrotreating of SRC-II whole coal liquid	86
	Group Type,								
	Saturates			44.1	36.7		31.2		
	Aromatics			55.9	63.3		68.8		
Coal-derived jet fuel from hydrotreated whole coal liquid	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	Group Type					Ft. Lewis pilot plant; from hydrofinishing of Chevron Sample No. SQG 6457 (300-550°F product from partial hydrotreating of SRC-II whole coal liquid) with ICR 113 catalyst. Operating conditions for Periods 1 through 4, respectively: Run Hours, 402-414, 426-438, 450-462, 462-486; average catalyst temperature, °F, 701, 700, 750, 751; LHSV, 2.03, 1.02, 1.00, 1.01; total pressure psig, 1350, 1346, 1703, 1700; H_2 mean pressure, psia, 1215, 1209, 1521, 1518.	86
			Saturates	56.2	63.6†	70.2	70.3		
			Aromatics	43.8	36.4	29.8	29.7		

(Continued)

Table 306 (Concluded)

Material	Process	Coal Type	Parameter	Value (wt %)						Sample Description/Source	Reference
				Period 1*	Period 2*	Period 3*	Period 4*	Period 5*			
Coal-derived jet fuel from hydro-treated whole coal liquid	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Black-ville No. 2 Mine)	Saturates	58.0	52.1	54.0	56.1	61.5		Ft. Lewis pilot plant; from hydrofinishing of Chevron Sample No. SGQ 6547 (300-550°F product from partial hydrotreating of SRC-II whole coal liquid) with ICR 113 catalyst. Operating conditions for Periods 1 through 5 respectively: Run Hours, 498-510, 522-524, 546-558, 570-582, 594-606; average catalyst temperature, °F, 750, 701, 725, 750, 775: LHSV, 1.00, 0.99, 1.03, 1.07, 0.98; total pressure psig, 1713, 2096, 2099, 2050, 2099; H_2 mean pressure psig, 1535, 1912, 1887, 1834, 1874.	86
			Aromatics	42.0	47.8	46.0	43.8	38.5			
				Period 1*	Period 2*	Period 3*	Period 4*	Period 5*	Period 6*		
		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Black-ville No. 2 Mine)	Saturates	94.3	94.1	86.4	79.9	67.9	65.9	Ft. Lewis pilot plant; from hydrofinishing of Chevron Sample No. SGQ 6581 (300-550°F product from partial hydrotreating of SRC-II whole coal liquid) with ICR 106 catalyst. Operating conditions for Periods 1 through 6 respectively: Run Hours, 92-104, 104-128, 140-152, 164-176, 188-200, 212-224; average catalyst temperature, °F, 724, 727, 727, 704, 704, 728; LHSV, 1.02, 1.00, 2.00, 1.99, 1.91, 2.00; total pressure psig, 1699, 1697, 1696, 1694, 1397, 1399; H_2 mean pressure, psig, 1528, 1528, 1527, 1535, 1250, 1251.	86
			Aromatics	5.7	5.9	13.6	20.1	32.1	34.2		

Explanatory Note

*Each period refers to a run having a characteristic set of operating conditions.

†Data may be questionable

Table 307. Hydrocarbon Compound Class Properties of Jet/Diesel/Heating Fuels From Various Distillation Cuts of H-Coal Syncrudes

Part A. From Severe Hydrotreatment over Fresh ICR 106 Catalyst in Jet/Diesel Fuel Production (Reference 95)

Coal Type	Illinois H-Coal			Rerun Illinois H-Coal	Wyodak H-Coal		
Operating conditions:							
Catalyst temperature, °F	750			748	752		
LHSV	0.5			1.5	1.0		
Run (Hours)	76-171 (222-246)			76-176 (463-475)	76-173 (331-355)		
Boiling Range, °F	250^{+}	300^{+}	350^{+}	250^{+}	250^{+}	300^{+}	350^{+}
Group Types by MS, LV %							
Saturates	97.7	97.8	97.5	94.3	96.4	96.1	96.2
Aromatics	2.3	2.3	2.5	5.7	3.6	3.9	3.8

Part B. From Severe Hydrotreatment over Aged ICR 106 Catalyst for Jet/Diesel Fuel Production (Reference 95)

Coal Type	Wyodak H-Coal		Rerun Wyodak H-Coal			Illinois H-Coal		Rerun Illinois H-Coal
Operating conditions:								
Catalyst temperature, °F	802		803			774		802
LHSV	1.0		1.5			0.5		1.5
Run (Hours)	76-174 (208-232)		76-174 (604-616)			76-171 (3193-32)		76-174 (364-376)
Boiling Range, °F	250-600	250^{+*}	250^{+}	300^{+}	350^{+}	250^{+}	350^{+*}	250^{+}
Group Types by MS, LV %								
Saturates	80.6	76.3	85.8	85.4	76.1	89.1	81.5	84.5
Aromatics	19.4	23.7	14.2	14.6	23.9	10.9	18.5	15.6

Part C. From Moderate Hydrotreatment over Fresh ICR 106 and 113 Catalysts for Heating Fuels Production (Reference 95)

Coal Type/Catalyst	Illinois H-Coal/ICR 106			Wyodak H-Coal/ICR 113
Operating conditions:				
Catalyst temperature, °F	775			747
LHSV	1.5			1.5
Run (Hours)	76-171 (1967-1991)			66-203 (1366-1390)
Boiling Range, °F	250^{+}	300^{+}	350^{+}	250^{+}
Group Types, LV %				
Saturates	46.5	43.9	41.4	50.8
Aromatics	53.5	56.0	58.6	49.2

Part D. From Moderate Hydrotreatment over Fresh ICR 106 Catalyst for Fuel Oil Production (Reference 95)

Coal Type	2500 psig IL. No. 6			2000 psig IL. No. 6			2000 psig IL. No. 6		
Operating conditions:									
Run (Hours)	76-171 (654-678)			76-171 (1535-1559)			76-171 (1967-1991)		
Catalyst temperature, °F	750			750			775		
LHSV	1.5			1.5			1.5		
Total Pressure, psig	2493			2001			2073		
H_2 Pressure, psia	2231			1773			1859		
Boiling Range, °F	250^{+}	300^{+}	350^{+}	250	300	350	250	300	350
Group Types by MS, LV %									
Saturates	42.6	40.6	42.5	46.9	43.3	40.0	46.5	43.9	41.4
Aromatics	57.4	59.4	57.5	53.1	56.6	60.0	53.5	56.0	58.6

*Measured at other hours but these conditions.

GENERAL COMMENTS

1. Additional data for SRC-I coal raw middle distillates (Reference 82):

   (a) Wilsonville pilot plant SRC unit, Run No. 220, APCI Sample No. 1897CB: compatibility (via ASTM D-2781), 1; DuPont stability rate; good/8^+.

   (b) Wilsonville pilot plant SRC unit, Run No. 225, APCI Sample No. 1911CB: compatibility (via ASTM D-2781), 1; DuPont stability rating, good/8^+.

   (c) Middle distillate from the Lummus LC-Finer unit for the Wilsonville pilot plant, Lummus Run No. 2-LC Finer-29, APCI Sample No. 1941CB-1: compatibility (via ASTM D-2781), 1; DuPont stability rating, fair/8.

   (d) Middle distillate from the Lummus LC-Finer unit for the Wilsonville pilot plant, Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB: compatibility (via ASTM D-2781), 1; DuPont stability rating, good/5.

2. Surface tension of SRC-II middle distillate from Ft. Lewis pilot plant was 33.3 dynes/cm at 60°F (Reference 102).

3. Data cited for Reference 97 for H-coal naphtha derived from PDU atmospheric and vacuum still overhead streams are for the following operating conditions: 2.245 psig at the reactor outlet and 850°F reactor temperatures. In the fuel oil mode of operation, a coal feed rate of 62.4 lbs/hr/ft^3 reactor with hot separator reactor slurry recycle of 1.045 lbs/lb coal and a distillate recycle of 1.40 lbs/lb coal yielded a feed slurry containing 29.03 weight-percent coal. The blend of material produced by the reactor operation consisted of 27.9 weight-percent overhead produce (distillate) and 72.1 weight-percent vacuum bottoms product. In the syncrude mode of operation, a coal feed rate of 31.2 lbs/hr/ft^3 reactor with a hot separator reactor slurry recycle of 3.98 lbs/lb coal and a distillate recycle of 0.40 lbs/lb coal yielded a feed slurry containing 20.08 weight-percent coal. The blend of material produced by the reactor in the syncrude mode of operation consisted of 48.2 weight-percent overhead product and 51.8 weight-percent vacuum bottoms product. The amount of reacted hydrogen in the fuel oil and the syncrude mode of operation were determined to be 12.2 and 15.2 Mscf/ton coal, respectively. The catalyst used in both processes was American Cyanamid HDS-2A.

4. Summary of operating conditions for H-Coal PDU Run 5, Run 130-82, Period 29, using IL No. 6 coal (catalyst-American Cyanamid HDS-1442A, 1/16-in. evenudates, HRI 3830, 96.7 lbs dry initial charge, reactor liquid phase depth 19 feet, volume 7.49ft^3), as follows (Reference 111):

Period	29
Date, End of Period (1977)	10/3
Hours of Run - Beginning	669
End	693
Catalyst Inventory, Beginning, Lbs	100.8
Catalyst Added	3.75
Catalyst Withdrawn	4.26
Catalyst Age (End), Lbs Dry Coal/Lb Catalyst	
Average*	1102
Original Charge†	1645
Catalyst Added, Cumulative, Lbs/Ton Dry Coal	1.06
Coal Feed (Dry), Lbs/Hr/Ft3 Reactor Volume	31.56
Moisture, W %	3.04
Ash, % (Dry Basis)	10.85
Recycle Flows, Lbs/Lb Solids	
Atmospheric Still Bottoms	0.552
Vacuum Still Overhead	0.000
Inventory Change	-0.005
Hydroclone Overflow (OII)	1.041
Make-Up Oil	0.000
Total	1.598
Temperature, °F	
Coal Preheater Outlet	741
Reactor Liquid Phase - Average	851
Maximum	861
Separator	801
Hydroclone	532
Vacuum Still Flash Zone	539
Pressure in Vacuum Flash, Torr	2.0
Pressure, psig	
Unit Back Pressure	2700
Hydrogen Make-Up	2950
Hydrogen Partial Pressure (Reactor Outlet)	1920
Recycle Gas, MSCF/Ton Dry Coal	39.9
Vent Gas, MSCF/Ton Dry Coal	7.85
Hydrogen Purity of Recycle Gas & Vent, %	85.7
Total Hydrogen, MSCF/Ton Dry Coal (Reactor outlet)	42.4

Make-Up Hydrogen + Recycle Hydrogen	
MSCF/Ton Dry Coal	62.0
V % of Make-Up & Recycle Gas	91.6
Hydrogen Partial Pressure, psig	2720
Hydrogen Consumption‡	
MSCF/Ton Dry Coal	19.6
W % Dry Coal	5.19
Oil Additions	
Make-Up Oil - Lbs/Lb Dry Coal	0.000
Lbs/H-/Ft^3 Reactor	0.000
Flush Oil, Lbs/Lb Dry Coal	0.0033

*Average age weighted by proportions of catalyst of various ages in bed

†Age of portion of original catalyst remaining in bed

‡Orifice for fresh hydrogen, meter for product gases with analysis

5. Summary of operating conditions for H-Coal PDU Run 6, Run 130-83, Period 17, using Wyodak coal (Catalyst-American Cyanamid HDS-1442A, 1/16-in. extrudates, HRI 3830, reactor liquid phase depth 19 feet, volume 7.49 ft^3), as follows (Reference 112):

Period	17
Date, End of Period (1977)	11/30
Hours of Run - Beginning	377
End	400
Catalyst Inventory, Beginning, Lbs	95.90
Catalyst Added	4.88
Catalyst Withdrawn	0.0
Catalyst Age (End), Lbs Dry Coal/Lb Catalyst	
Average*	669
Original Charge†	849
Catalyst Added, Cumulative, Lbs/Ton Dry Coal	1.08
Coal Feed (Dry), Lbs/Hr/Ft3 Reactor Volume	30.1
Moisture, W %	18.19
Ash, % (Dry Basis)	9.33
Recycle Flows, Lbs/Lb Solids	
Atmospheric Still Bottoms	0.990
Vacuum Still Overhead	0.024
Inventory Change	0.026
Hydroclone Overflow (OII)	0.568
Make-Up Oil	0.000
Total	1.556

Temperature, °F	
Coal Preheater Outlet	615
Reactor Liquid Phase - Average	838
Maximum	852
Separator	797
Hydroclone Overflow	544
Vacuum Still Flash Zone	497
Pressure in Vacuum Flash, Torr	25
Pressure, psig	
Unit Back Pressure	2805
Hydrogen Make-Up	2905
Hydrogen Partial Pressure (Reactor Outlet)	1620
Recycle Gas, MSCF/Ton Dry Coal	33.48
Vent Gas, MSCF/Ton Dry Coal	8.86
Hydrogen Purity of Recycle Gas & Vent, %	83.8
Total Hydrogen, MSCF/Ton Dry Coal (Reactor outlet)	37.33
Make-Up Hydrogen + Recycle Hydrogen	
MSCF/Ton Dry Coal	62.19
V % of Make-Up & Recycle Gas	91.98
Hydrogen Partial Pressure, psig	2690
Hydrogen Consumption[‡]	
MSCF/Ton Dry Coal	24.87
W % Dry Coal	6.60
Oil Additions	
Make-Up Oil - Lbs/Lb Dry Coal	0.000
Lbs/H-/Ft^3 Reactor	0.000
Flush Oil, Lbs/Lb Dry Coal	0.0036

[*] Average age weighted by proportions of catalyst of various ages in bed

[†] Age of portion of original catalyst remaining in bed

[‡] Orifice for fresh hydrogen, meter for product gases with analysis

6. Data cited for Reference 88 for SRC-II single-stage hydrotreated <554°F distillate were obtained under the following operating conditions:

Catalyst	ICR-113
Catalyst temperature	750°F
Hydrogen partial pressure	2306 psig
LHSV	0.5
Recycle gas rate	13,752 SCF/bbl

7. Data cited for Reference 88 for H-Coal single-stage hydrotreated <544°F distillate were obtained under the following operating conditions:

IL No. 6 Coal

Catalyst	ICR-113
Catalyst temperature	750°F
Hydrogen partial pressure	2232 psig
LHSV	0.5
Recycle gas rate	7,921 SCF/bbl

Wyodak Coal

Catalyst	ICR-113
Catalyst temperature	752°F
Hydrogen partial pressure	2257 psig
LHSV	1.0
Recycle gas rate	7,743 SCF/bbl

8. The following additional data provided for SRC-II medium and heavy distillate blends (Reference 115):

	Before water wash	After water wash
Chevron Sample No.	SGQ-7559	WOW-4551
H/C Ratio	1.24	1.22
N/C Ratio x 10^3	8.7	8.9
S/C Ratio x 10^3	1.11	1.13
O/C Ratio x 10^3	28.6	41.9

Part X. Raw and Hydrotreated Heavy Distillates (Heavy Fuel Oils) and Residua

Table 308. Specific Gravity

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	1.0921*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)†	82
		KY No. 9	1.1085*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)†	82
		KY No. 9	1.0404*	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1942CB-1)†	82
		KY No. 9	1.0736*	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)†	82
		KY No. 9	1.219	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	1.221	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	1.213	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
		NA	0.985 (450°F/60°F)	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run No. 6, Drum No. 120, Babcock & Wilcox Sample No. C-13994)	120

(Continued)

Table 308 (Continued)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	NA	1.005 (450°F/ 60°F)	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run No. 7D, Drum No. 97, Babcock & Wilcox Sample No. C-13995)	120
		KY No. 9 and 14	1.24	Ft. Lewis pilot plant, heavy SRC	83
	EDS	IL No. 6	1.0100 (60/60°F)	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99
		IL No. 6	1.0800 (60/60°F)	One tpd pilot plant, 350°F^{+} distillate blend from "typical" run	99
		Wyodak	1.0306 (60/60°F)	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99
		Wyodak	1.1370 (60/60°F)	One tpd pilot plant, 350°F^{+} distillate blend from "typical" run	99
		IL No. 6	1.0397	One tpd pilot plant, heavy distillate[‡]	99
		IL No. 6	1.0435	One tpd pilot plant, heavy distillate[‡]	99
		IL No. 6	1.0752	One tpd pilot plant, heavy distillate[§]	99
		IL No. 6	1.0173	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-1[‡]	99
		IL No. 6	1.0143	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-2[‡]	99
		IL No. 6	1.0173	One tpd pilot plant, heavy distillate, UOP Sample No. 3523-3[‡]	99

(Continued)

Table 308 (Continued)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	Wyodak	1.0321	One tpd pilot plant, heavy distillate[#]	99
		Wyodak	1.1195	One tpd pilot plant, heavy distillate**	99
		Wyodak	1.1320	One tpd pilot plant, heavy distillate**	99
		IL No. 6	1.3717 (60/60°F)	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
		IL No. 6 (Monterey Mine)	1.47 ± 0.12 (60/60°F)	One tpd pilot plant, vacuum bottoms, average of three operating conditions (840°F reactor temperature, 15-40 minues residence time)	99
		IL No. 6 (Monterey (Mine)	1.37 ± 0.05 (60/60°F)	One tpd pilot plant, vacuum bottoms; operating conditions: 840°F reactor temperature; 40 minutes residence time, average of ten yield periods	99
		Wyodak	1.3849 (60/60°F)	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
		Wyodak	1.38 ± 0.04 (60/60°F)	One tpd pilot plant, vacuum bottoms, average of six operating conditions (800-840°F reactor temperature, 40-100 minutes residence time)	99
		Wyodak	1.40 ± 0.05 (60/60°F)	One tpd pilot plant, vacuum bottoms; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
	H-Coal	IL No. 6	1.0932[†] (77°F)	Heavy distillate from PDU Run 8, syncrude mode	109

(Continued)

Table 308 (Continued)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Hydro-treated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	1.184	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116
		KY No. 9	1.217	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116
		KY No. 9	1.175	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1983CB)	117
		KY No. 9	1.189	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1991CB)	117
	EDS	IL No. 6	0.9522	From first stage hydrocracking of UOP raw 400°F^{+} heavy distillate, Sample No. 3532-3‡ (UOP Sample No. 3532-9)‡	99
		IL No. 6	0.9129	From first stage hydrocracking of UOP raw 400°F^{+} heavy distillate Sample No. 3532-2‡ (UOP Sample No. 3532-4)‡	99

(Continued)

Table 308 (Concluded)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	0.8044	From second stage hydrocracking of UOP hydrocracked Sample No. 3532-4 (UOP Sample No. 3532-17)	99
		IL No. 6	0.7981	From second stage hydrocracking of UOP hydrocracked Sample No. 3532-4 (UOP Sample No. 3532-18)	99

Explanatory Notes

[*] Determined via ASTM D-1298.

[†] The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

[‡] A blend of raw naphtha, vacuum gas oil, and raw process solvent having a nominal boiling point of 400-1000°F.

[§] A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F$^+$.

[#] A full range (350 to 1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw process solvent.

[**] A blend of raw naphtha, vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 350°F$^+$.

[††] Determined via ASTM D-70.

Table 309. API Gravity

Material	Process	Coal Type	Value (degrees)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	-2.0*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)†	82
		KY No. 9	-4.1*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)†	82
		KY No. 9	4.5*	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1942CB-1)†	82
		KY No. 9	0.3*	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)†	82
		NA	-22.0	Wilsonville pilot plant, heavy SRC	119
		Kentucky	-18	Heavy SRC	98
	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	1.3	Ft. Lewis pilot plant, heavy distillate	101
		NA	0.2	Ft. Lewis pilot plant, heavy distillate	84
		NA	0.9	Ft. Lewis pilot plant, heavy distillate	84
		Kentucky	+3/+6	Ft. Lewis pilot plant, 482-860°F heavy distillate	98

(Continued)

Table 309 (Continued)

Material	Process	Coal Type	Value (degrees)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	10.7	400°F$^+$ distillate, Ft. Lewis pilot plant, Chevron Sample No. WOW-3751	86
	EDS	IL No. 6 (Monterey Mine)	0	One tpd pilot plant, heavy distillate[‡]	104
		Wyodak	10.3	One tpd pilot plant, heavy distillate[§]	101
		IL No. 6	3.5	One tpd pilot plant, heavy distillate, as received[‡]	123
		IL No. 6	8.0	One tpd pilot plant, rerun heavy distillate[‡]	123
		IL No. 6	4.6	One tpd pilot plant, heavy distillate[#]	99
		IL No. 6	4.1	One tpd pilot plant, heavy distillate[#]	99
		IL No. 6	0.1	One tpd pilot plant, heavy distillate[‡]	99
		IL No. 6	7.6	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-1[#]	99
		IL No. 6	8.0	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-2[#]	99
		IL No. 6	7.6	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-3[#]	99

(Continued)

Table 309 (Continued)

Material	Process	Coal Type	Value (degrees)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	8.6	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99
		IL No. 6	-0.5	One tpd pilot plant, 350°F$^+$ distillate blend from "typical" run	99
		Wyodak	5.6	One tpd pilot plant, heavy distillate§	99
		Wyodak	-5.1	One tpd pilot plant, heavy distillate**	99
		Wyodak	-6.0	One tpd pilot plant, heavy distillate**	99
		Wyodak	5.8	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99
		Wyodak	-7.1	One tpd pilot plant, 350°F$^+$ distillate blend from "typical" run	99
		IL No. 6	-29.5	One tpd pilot plant, residuum (flexicoker vacuum bottoms)	124
		IL No. 6	-28.3	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
		IL No. 6 (Monterey (Mine)	-34.56 ± 7.82	One tpd pilot plant, vacuum bottoms; average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	-28.34 ± 3.63	One tpd pilot plant, vacuum bottoms; operating conditions: 840°F reactor temperature, 40 minutes residence time, average of ten yield periods	99

(Continued)

Table 309 (Continued)

Material	Process	Coal Type	Value (degrees)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	Wyodak	-29.3	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
		Wyodak	-28.74 ± 3.13	One tpd pilot plant, vacuum bottoms, average of six operating conditions (800-840°F reactor temperature; 40-100 minutes residence time)	99
		Wyodak	-29.97 ± 3.72	One tpd pilot plant, vacuum bottoms; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99
	H-Coal	NA	9.2	400-900°F heavy distillate from PDU	101
		IL No. 6 (Burning Star Mine)	5.4	Heavy distillate from PDU (Ashland Oil sample)	96
		IL No. 6	5.0	650-975°F heavy distillate from PDU, syncrude mode	98
		IL No. 6	1.3	Heavy distillate from PDU, syncrude mode	109
		IL No. 6	<0	Heavy distillate from PDU Run 8, syncrude mode[††]	109
		IL No. 6	-5.9	650-975°F heavy distillate from PDU Run 5, Run 130-82, Period 29[‡‡]	111
		Wyodak	3.9	650-975°F heavy distillate from PDU Run 6, Run 130-83, Period 17[§§]	112
		NA	7.4 (60°F)	400°F$^+$ fuel oil product from PDU, as received	123
		NA	8.9 (60°F)	400°F$^+$ fuel oil product from PDU, rerun	123

(Continued)

Table 309 (Continued)

Material	Process	Coal Type	Value (degrees)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	H-Coal	IL No. 6	-12.9	975°F$^+$ residue from PDU Run 5, Run 130-82, Period 29	111
		Wyodak	-15.7	975°F$^+$ residue from PDU Run 6, Run 130-83, Period 17[§§]	112
Coal raw heavy distillate blends (heavy fuel oils)	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	4.7	0.4/1 middle/heavy distillate blend, Ft. Lewis pilot plant	101
Hydro-treated heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	17.1	From first strage hydro-cracking of UOP raw 400°F$^+$ heavy distillate Sample No. 3532-3# (UOP Sample No. 3532-9)	99
		IL No. 6	23.5	From first stage hydro-cracking of UOP raw 400°F$^+$ heavy distillate Sample No. 3532-2# (UOP Sample No. 3532-4)	99
		IL No. 6	44.4	From second stage hydro-cracking of UOP hydrocracked Sample No. 3532-4 (UOP Sample No. 3532-17)	99
		IL No. 6	45.8	From second stage hydro-cracking of UOP hydrocracked Sample No. 3532-4 (UOP Sample No. 3532-18)	99

(Continued)

Table 309 (Concluded)

Explanatory Notes

*Determined via ASTM D-1287.

†The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

‡A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F+.

§A full range (350 to 1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw process solvent.

#A blend of raw naphtha, vacuum gas oil, and raw process solvent having a nominal boiling point of 400-1000°F.

**A blend of raw naphtha, vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 350°F+.

††Determined via ASTM D-1298 (by hydrometer).

‡‡See Part IX, General Comments section, Note 4, for summary of operating conditions used.

§§See Part IX, General Comments section, Note 5, for summary of operating conditions used.

Table 310. Density

Material	Process	Coal Type	Value (g/ml)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	NA	29.9	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2440-C	118
			28.0	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2441-C	118
		KY No. 9 and 14	38.1 (bulk)	Ft. Lewis pilot plant, heavy SRC	83
		Kentucky	430-440 (lb/bbl)	Heavy SRC	98
	SRC-II	Kentucky	360-368 (lb/bbl)	Ft. Lewis pilot plant, 482-860°F heavy distillate	98
	EDS	IL No. 6	1.08	One tpd pilot plant, heavy distillate*	89
		NA	1.15	One tpd pilot plant, vacuum bottoms (DuPont "Notebook" Sample No. 16928)	91
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	1.182	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116

(Continued)

Table 310 (Concluded)

Material	Process	Coal Type	Value (g/ml)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	1.206 (g/cm^3)	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116
		KY No 9	1.176 (g/cm^3)	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1983CB)	117
		KY No. 9	1.183 (g/cm^3)	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1991CB)	117
	EDS	IL No. 6	1.01	Hydrotreated 400°F$^+$ distillate from one tpd pilot plant*	89

Explanatory Note

*A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F$^+$.

Table 311. Reid Vapor Pressure

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	0.0*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)†	82
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydro-treated heavy distillates (heavy fuel oils) and residua	NA	--	--	--	--

Explanatory Notes

*Determined via ASTM D-323

†The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

Table 312. Distillation Data

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I*	KY No. 9	640°F-IBP* 664°F-10 670°F-15 672°F-20 696°F-30 718°F-40 740°F-50 788°F-60 834°F-70 NA-80 880°F-90 NA-EP	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)[†]	82
		KY No. 9	650°F-IBP* 672°F-10 678°F-15 679°F-20 688°F-30 702°F-40 714°F-50 737°F-60 750°F-70 774°F-80 835°F-90 850°F-EP	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)[†]	82
		KY No. 9	624°F-IBP* 679°F-10 NA-15 678°F-20 676°F-30 677°F-40 678°F-50 677°F-60 684°F-70 687°F-80 714°F-90 742°F-EP	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1942CB-1)[†]	82

(Continued)

Table 312 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I*	KY No. 9	619°F-IBP* 672°F-10 NA-15 672°F-20 671°F-30 674°F-40 674°F-50 670°F-60 671°F-70 681°F-80 711°F-90 741°F-EP	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)[†]	82
	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	454°F-IBP[‡] 552°F-10 570°F-20 584°F-30 596°F-40 620°F-50 642°F-60 668°F-70 712°F-80 NA-90 720°F-EP	Ft. Lewis pilot plant, heavy distillate	101
			NA[§]-IBP* NA[§]-10 NA[§]-20 559°F-30 570°F-40 615°F-50 629°F-60 658°F-70 698°F-80 777°F-90 658°F-EP	Ft. Lewis pilot plant, heavy distillate	101

(Continued)

Table 312 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	NA	367°F-IBP[‡] 490°F-5 527°F-10 572°F-30 603°F-50 658°F-70 745°F-90 796°F-95 930°F-EP	Ft. Lewis pilot plant, heavy distillates	84
		NA	533°F-IBP[‡] 569°F-5 589°F-10 608°F-30 632°F-50 678°F-70 750°F-86 ND-95 ND-EP	Ft. Lewis pilot plant, heavy distillate	84
		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	393/413-IBP/5 427/448-10/30 471-50 506/590-70/90 662/847-95/EP	400°F$^+$ distillate, Ft. Lewis pilot plant, Chevron Sample No. WOW-3751	86
	EDS	IL No. 6	477°F-10 694°F-50 811°F-90	One tpd pilot plant, heavy distillate	89

(Continued)

Table 312 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	Wyodak	NA-IBP* 398°F-10 414°F-20 437°F-30 476°F-40 520°F-50 574°F-60 626°F-70 698°F-80 867°F-90	One tpd pilot plant, heavy distillate#	101
		IL No. 6	396°F-IBP* 592°F-50 1043°F-EP	One tpd pilot plant, heavy distillate**	99
		IL No. 6	403°F-IBP* 696°F-50 1043°F-EP	One tpd pilot plant, heavy distillate††	99
		IL No. 6	406/428°F-IBP/5* 435/452°F-10/20 469/511°F-30/40 561/619°F-50/60 720/825°F-70/80 908/955°F-90/95 978°F-EP	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-1**	99

(Continued)

Table 312 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	408/436°F-IBP/5* 443/460°F 10/20 490/531°F-30/40 574/630°F-50/60 730/842°F-70/80 915°F-90/95 NA-EP	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-2**	99
		IL No. 6	400/424°F-IBP/5* 436/460°F 10/20 490/521°F 30/40 567/631°F 50/60 730/822°F 70/80 915°F-90/95 NA-EP	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-3**	99
		IL No. 6	392°F-5 520°F-50 867°F-95	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99
		IL No. 6	430°F-5 696°F-50 1010°F-95	One tpd pilot plant, 350°F$^+$ distillate blend from "typical" run	99

(Continued)

Table 312 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	Wyodak	405°F-10 568°F-50 845°F-95	One tpd pilot plant, 350 to 1000°F distillate blend	99
		Wyodak	399°F-10 714°F-50 943°F-95	One tpd pilot plant, 350F⁺ distillate blend	99
		IL No. 6	1000°F-3.6	One tpd pilot plant, bottoms from "typical" run (Run A-1)	99
		IL No. 6 (Monterey Mine)	5.36 ± 1.54 (1000°F minus content)	One tpd pilot plant, vacuum bottoms; average of three operating conditions(840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	3.59 ± 1.41 (1000°F minus content)	One tpd pilot plant, vacuum bottoms; operating conditions: 840°F reactor temperature, 40 minutes residence time, average of ten yield periods	99
		Wyodak	6.8-1000°F	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
		Wyodak	6.04 ± 1.32 (1000°F minus content)	One tpd pilot plant, vacuum bottom, average of six operating conditions (800-840°F reactor temperature; 40-100 minutes residence time)	99
		Wyodak	6.84 ± 0.62 (1000°F minus content)	One tpd pilot plant, vacuum bottoms; operating conditions: 840°F reactor temperature, 60 minutes residence time, average of seven yield periods	99

(Continued)

Table 312 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	Wyodak	584+ 36°F-5 788+ 44°F-50 952+ 20°F-95	75 lb per day development unit, vacuum bottoms; average of eight operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		Wyodak	653+ 30°F-5 787+ 29°F-50 936+ 24°F-95	75 lb per day development unit, vacuum bottoms; operating conditions 880°F reactor temperature, 25 minutes residence time, average of six yield periods	99
	H-Coal	NA	452°F-IBP* 527°F-10 548°F-20 573°F-30 586°F-40 619°F-50 633°F-60 691°F-70 736°F-80 795°F-90 894°F-EP	400-900°F heavy distillate from PDU	101
		NA	481°F-IBP* 519°F-10 533°F-20 552°F-30 572°F-40 594°F-50 618°F-60 NA-70 NA-80 NA-90 694°F-EP	400-900°F heavy distillate from PDU	101

(Continued)

Table 312 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6 (Burning Star Mine)	682°F-5 688°F-10 699°F-20 706°F-30 722°F-40 737°F-50 756°F-60 783°F-70 843°F-80 896°F-90 944°F-95 NA-EP	Heavy distillate from PDU (Ashland Oil sample)	96
		IL No. 6	342°F-IBP* 397°F-10 697°F-50 834°F-58 (cracked)	Heavy distillate from PDU Run 8, syncrude mode	109
		Wyodak	688°F-IBP 719°F-5 732°F-10 750°F-20 779°F-30 783°F-40 800°F-50 817°F-60 849°F-70 876°F-80 944°F-90 986°F-95 995°F-EP	650-975°F heavy distillate from PDU Run 6, Run 130-83, Period 17‡‡	112
Coal raw heavy distillate blends (heavy fuel oils)	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	153°F-IBP* 441°F-10 516°F-20 552°F-30 565°F-40 602°F-50 637°F-60 666°F-70 698°F-80 755°F-90 901°F-EP	0.4/1 middle/heavy distillate blend, Ft. Lewis pilot plant	101

(Continued)

Table 312 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Coal raw heavy distillate blends (heavy fuel oils)	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	388°F-IBP[‡] 461°F-10 490°F-20 530°F-30 559°F-40 590°F-50 618°F-60 NA-70 NA-80 NA-90 694°F-EP	0.4/1 middle/heavy distillate blend, Ft. Lewis pilot plant	101
Hydrotreated distillates (heavy fuel oils) and residua	EDS	IL No. 6	462°F-10 657°F-50 774°F-90	Hydrotreated 400°F$^+$ distillate from one tpd pilot plant[‡]	89
		IL No. 6	366/410°F-IBP/5 431/457°F-10/20 480/509°F-30/40 548/586°F-50/60 635/700°F-70/80 797/849°F-90/95 925°F-EP	From first stage hydrocracking of UOP raw 400°F$^+$ heavy distillate, Sample No. 3532-3** (UOP Sample No. 3532-9)	99

(Continued)

Table 312 (Continued)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	307/391°F-IBP/5 413/437°F-10/20 460/483°F-30/40 512/543°F-50/60 575/621°F-70/80 689/740°F-90/95 810°F-EP	From first stage hydrocracking of UOP raw 400°F$^+$ heavy distillate Sample No. 3532-2** (UOP Sample No. 3532-4)	99
		IL No. 6	161/187°F-IBP/5 200/222°F-10/20 244/270°F-30/40 302/341°F-50/60 385/432°F-70/80 504/540°F-90/95 560°F-EP	From second stage hydrocracking of UOP hydrocracked Sample No. 3532-4 (UOP Sample No. 3532-17)	99

(Continued)

Table 312 (Concluded)

Material	Process	Coal Type	Value (% Evaporation)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	164/ 184°F- IBP/5 196/ 215°F- 10/20 234/ 256°F- 30/40 282/ 317°F- 50/60 360/ 407°F- 70/80 474/ 514°F- 90/95 540°F-EP	From second stage hydrocracking of UOP Sample No. 3532-4 (UOP Sample No. 3532-18)	99

Explanatory Notes

*Determined via ASTM D-1160.

†The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

‡Determined via ASTM D-86

§Results were questionable due to presence of water in the sample.

#A full range (350 to 1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw process solvent.

**A blend of raw naphtha, vacuum gas oil, and raw process solvent having a nominal boiling point of 400-1000°F.

††A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F+.

‡‡See Part IX, General Comments section, Note 5, for summary of operating conditions used.

Table 313. GC Simulated Distillation Data

Material	Process	Coal Type	Boiling Point Range	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	548°F-IBP* 653°F-10 663°F-15 672°F-20 688°F-30 705°F-40 722°F-50 742°F-60 765°F-70 795°F-80 841°F-90 959°F-EP	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)†	82
		KY No. 9	605°F-IBP* 646°F-10 658°F-15 667°F=20 681°F-30 693°F-40 709°F-50 726°F-60 749°F-70 778°F-80 821°F-90 938°F-EP	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)†	82
		KY No. 9	634°F-IBP* 658°F-10 663°F-15 668°F-20 677°F-30 685°F-40 693°F-50 700°F-60 709°F-70 720°F-80 739°F-90 821°F-EP	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1942CB-1)†	82

(Continued)

Table 313 (Continued)

Material	Process	Coal Type	Boiling Point Range	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	624°F-IBP* 649°F-10 656°F-15 661°F-20 671°F-30 681°F-40 689°F-50 695°F-60 702°F-70 715°F-80 736°F-90 831°F-EP	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)†	82
		KY No. 9	712°F-IBP* 762°F-10 774°F-15 784°F-20 802°F-30 823°F-40 846°F-50 871°F-60 897°F-70 925°F-80 966°F-90 1158°F-EP	Wilsonville pilot plant, Alcoa coker unit (APCI Sample No. 1899CB)†	82
		KY No. 9	242°F-IBP* 258°F-5 688°F-10 722°F-15 754°F-20 807°F-30 848°F-40 885°F-50 920°F-60 952°F-70 988°F-80 1032°F-90 1057°F-95 1081°F-EP	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	117

(Continued)

Table 313 (Continued)

Material	Process	Coal Type	Boiling Point Range	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	241°F-IBP* 246°F-5 498°F-10 679°F-15 725°F-20 786°F-30 834°F-40 877°F-50 917°F-60 952°F-70 989°F-80 1033°F-90 1057°F-95 1081°F-EP	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	117
		KY No. 9	241°F-IBP* 247°F-5 636°F-10 710°F-15 755°F-20 819°F-30 870°F-40 911°F-50 944°F-60 9?6°F-70 1010°F-80 1047°F-90 1065°F-95 1082°F-EP	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	117
	SRC-II	NA	367°F-IBP* 490°F-5 527°F-10 5?2°F-30 603°F-50 658°F-70 745°F-90 796°F-95 930°F-EP	Ft. Lewis pilot plant, heavy distillate	84

(Continued)

Table 313 (Continued)

Material	Process	Coal Type	Boiling Point Range	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	NA	533°F-IBP* 569°F-5 589°F-10 608°F-30 632°F-50 678°F-70 750°F-90 ND-95 ND-EP	Ft. Lewis pilot plant, heavy distillate	84
		KY No. 9 and 14, IL No. 6 (King River Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	233/366-IBP/5 382/430-10/30 477-50 527/639-70/90 707/849-75/99	400°F$^+$ distillate, Ft. Lewis pilot plant, Chevron Sample No. WOW-3751	86
	EDS	Wyodak	361°F-IBP* 568°F-50 1009°F-EP	One tpd pilot plant, heavy distillate[†]	99
		Wyodak	355°F-IBP* 714°F-50 1083°F-EP	One tpd pilot plant, heavy distillate[§]	99
	H-Coal	IL No. 6	604°F-IBP* 624°F-5 634°F-10 651°F-20 661°F-30 671°F-40 681°F-50 688°F-60 700°F-70 714°F-80 746°F-90 784°F-95 883°F-EP	Heavy distillate from PDU, syncrude mode	109

(Continued)

Table 313 (Continued)

Material	Process	Coal Type	Boiling Point Range	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	H-Coal	Wyodak	596°F-IBP* 620°F-5 634°F-10 652°F-20 665°F-30 676°F-40 691°F-50 704°F-60 726°F-70 755°F-80 809°F-90 862°F-95 966°F-EP	Heavy distillate from PDU, syncrude mode	109
		W. KY No. 11	530°F-IBP* 640°F-5 652°F-10 671°F-20 688°F-30 704°F-40 719°F-50 738°F-60 761°F-70 790°F-80 842°F-90 898°F-95 1014°F-EP	Heavy distillate from PDU, syncrude mode	109
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydrotreated heavy distillate (heavy fuel oils) and residua	NA	--	--	--	--

(Continued)

Table 313 (Concluded)

Explanatory Notes

[†] The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

*Determined via ASTM D-2887.

[‡] A full range (350-1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw process solvent.

[§] A blend of raw naphtha, vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of $350°F^+$.

Table 314. Refractive Index

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw heavy distillate (heavy fuel oils) and residua	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	1.5340 (176°F)	400°F+ distillate, Ft. Lewis pilot plant, Chevron Sample No. WOW-3751	86
	H-Coal	IL No. 6	1.556 (68°F)	650-975°F heavy distillate from PDU, syncrude mode	98
		IL No. 6	1.644	650-975°F heavy distillate from PDU Run 5, Run 130-82, Period 29*	111
		Wyodak	1.5784	650-975°F heavy distillate from PDU Run 6, Run 130-83, Period 17†	112
Coal raw heavy distillate blends (heavy fuel oils) and residua	NA	--	--	--	--
Hydrotreated heavy distillates (heavy fuel oils) and residua	NA	--	--	--	--

Explanatory Notes

*See Part IX, General Comments section, Note 4, for summary of operating conditions used.

†See Part IX, General Comments section, Note 5, for summary of operating conditions used.

Table 315. Molecular Weight

Material	Process	Coal Type	Value (g/mole)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	275	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)*	82
		KY No. 9	235	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI, Sample No. 1912CB)*	82
		KY No. 9	215	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1942CB-1)*	82
		KY No. 9	150	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)*	82
		KY No. 9	595	Wilsonville pilot plant, heavy SRC (Run 225, APCI Sample No. 1914CB)	116
		KY No. 9	605	Wilsonville pilot plant, heavy SRC (Run 220, APCI Sample No. 1916CB)	116
		KY No. 9	610	Wilsonville pilot plant, heavy SRC (Run 209, APCI Sample No. 1917CB)	116
	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	69	400°F$^+$ distillate, Ft. Lewis pilot plant, Chevron Sample No., WOW-3751	86

(Continued)

Table 315 (Concluded)

Material	Process	Coal Type	Value (g/mole)	Sample Description/Source	Reference
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	455	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116
		KY No. 9	445	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116
	EDS	IL No. 6	238	From first stage hydrocracking of UOP raw 450°F+ heavy distillate Sample No. 3532-3† (UOP Sample No. 3532-9)	99

Explanatory Notes

*The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

†A blend of raw naphtha, vacuum gas oil, and raw process solvent having a nominal boiling point of 400-1000°F.

Table 316. Total Acid Number

Material	Process	Coal Type	Value (mg KOH/g)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	25.7*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)†	82
		KY No. 9	21.6*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)†	82
		KY No. 9	4.4*	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1942CB-1)†	82
		KY No. 9	5.29*	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)†	82
	H-Coal	IL No. 6	1.15	Heavy distillate from PDU Run 8, syncrude mode	109
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydro-treated heavy distillates (heavy fuel oils) and residua	NA	--	--	--	--

(Continued)

Table 316 (Concluded)

Explanatory Notes

*Determined via ASTM D-664

[†] The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

Table 317. Gum Content

Material	Process	Coal Type	Value (mg/ 100 ml)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	NA	--	--	--	--
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydro-treated heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	596	From first stage hydrocracking of UOP raw 400°F$^+$ heavy distillate Sample No. 3532-3* (UOP Sample No. 3532-9)	99

Explanatory Notes

*A blend of raw naphtha, vacuum gas oil, and raw process solvent having a nominal boiling point of 400-1000°F.

Table 318. Viscosity

Material	Process	Coal Type	Value (centi-stoke)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	325 (150°F)* 40 (210°F)	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)†	82
		KY No. 9	1684 (100°F)* 270 (150°F) 27 (210°F)	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)†	82
		KY No. 9	158.8 (68°F)* 36.7 (104°F) 14.0 (140°F)	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1942CB-1)†	82
		KY No. 9	19.4 (140°F)* 8.24 (167°F) 5.94 (194°F)	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)†	82
		Kentucky	Solid (100°F)	Heavy SRC	98
	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	67.2 (SSU at 140°F) 41.3 (SSU at 210°F)	Ft. Lewis pilot plant, heavy distillate	101
		NA	44.54 (104°F) 4.06 (212°F)	Ft. Lewis pilot plant, heavy distillate	84
		NA	30.76 (104°F) 3.45 (212°F)	Ft. Lewis pilot plant heavy distillate	84

(Continued)

Table 318 (Continued)

Material	Process	Coal Type	Value (centistoke)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	Kentucky	7-10 (100°F)	Ft. Lewis pilot plant, 482-860°F heavy distillate	98
		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	4.213 (100°F) 1.238 (210°F)	400°F$^+$ distillate, Ft. Lewis pilot plant, Chevron Sample No. WOW-3751	86
	EDS	IL No. 6 (Monterey Mine)	158(SSU at 1220°F)	One tpd pilot plant, heavy distillate[‡]	104
		Wyodak	37.7 (150°F)	One tpd pilot plant, heavy distillate[§]	101
		IL No. 6	21.0 (100°F) 3.1 (210°F)	One tpd pilot plant, heavy distillate[#]	99
		IL No. 6	440 (100°F) 10.4 (210°F)	One tpd pilot plant, heavy distillate[‡]	99
		IL No. 6	5.5 (100°F) 2.0 (210°F)	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99
		IL No. 6	4.6 (210°F)	One tpd pilot plant, 350°F$^+$ distillate blend from "typical" run	99
		Wyodak	10.4 (100°F) 2.3 (210°F)	One tpd pilot plant, heavy distillate[§]	99

(Continued)

Table 318 (Continued)

Material	Process	Coal Type	Value (centi-stoke)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	Wyodak	2920 (100°F) 26.0 (210°F)	One tpd pilot plant, heavy distillate**	99
		Wyodak	11.3 (100°F) 2.3 (210°F)	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99
		Wyodak	10,300 (150°F) 269 (210°F)	One tpd pilot plant, 350°F$^+$ distillate blend from "typical" run	99
		IL No. 6	800 (cp at 600°F, 21.4 sec^{-1})	One tpd pilot plant, residuum (flexicoker vacuum bottoms)	124
		IL No. 6	100,000 (440°F) 1,000 (550°F)	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
		Wyodak	10,000 (520°F) 2,500 (690°F)	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
		Wyodak	68±78 (poise, at 550°F)	75 lb per day development unit, vacuum bottoms; average of eight operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		Wyodak	10±4 (poise, at 550°F)	75 lb per day development unit, vacuum bottoms; operating conditions: 880°F reactor temperature, 25 minutes residence time, average of six yield periods	99

(Continued)

Table 318 (Continued)

Material	Process	Coal Type	Value (centistoke)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	H-Coal	NA	43.5 (140°F) 35.7 (210°F)	400-900°F heavy distillate from PDU	101
		IL No. 6	35 (210°F)	650-975°F heavy distillate from PDU, syncrude mode	98
		IL No. 6	121.7 (104°F) 6.368 (212°F)	Heavy distillate from PDU, syncrude mode	109
		Wyodak	113.1 (104°F) 11.13 (212°F)	Heavy distillate from PDU, syncrude mode	109
		W. KY No. 11	597.3 (104°F) 11.24 (212°F)	Heavy distillate from PDU, syncrude mode	109
		IL No. 6	30,400 (122°F)* 66.1 (212°F)*	Heavy distillate from PDU Run 8, syncrude mode	109
		IL No. 6	33 (SSU at 210°F)	650-975°F heavy distillate from PDU Run 5, Run 130-82, Period 29[††]	111
		IL No. 6	9900 (cps at 450°F) 880 (cps at 500°F)	975°F^{+} residue from PDU Run 5, Run 130-82, Period 29[††]	111
Coal raw heavy distillate blends (heavy fuel oils)	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	46.7 (SSU at 140°F) 35.2 (SSU at 210°F)	0.4/1 middle/heavy distillate blend, Ft. Lewis pilot plant	101

Table 318 (Concluded)

Material	Process	Coal Type	Value (centistoke)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	NA	--	--	--	--

Explanatory Notes

[*] Determined via ASTM D-445.

[†] The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

[‡] A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F^{+}.

[§] A full range (350 to 1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw process solvent.

[#] A blend of raw naphtha, vacuum gas oil, and raw process solvent having a nominal boiling point of 400-1000°F.

[**] A blend of raw naphtha, vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 350°F^{+}.

[††] See Part IX, General Comments section, Note 4, for summary of operating conditions used.

Table 319. Pour Point

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	93.2*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)†	82
		KY No. 9	69.0*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)†	82
		KY No. 9	-30*	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1942CB-1)†	82
		KY No. 9	-8*	Wilsonville pilot plant heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)†	82
		NA	350	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run No. 6, Drum No. 120, Babcock & Wilcox Sample No. 13994)	120
		NA	355	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run No. 7D, Drum No. 97, Babcock & Wilcox Sample No. C-13995)	120

(Continued)

Table 319 (Continued)

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	-50	400°F[+] distillate, Ft. Lewis pilot plant, Chevron Sample No. WOW-3751	86
		NA	0	Ft. Lewis pilot plant, heavy distillate	84
		NA	0	Ft. Lewis pilot plant, heavy distillate	84
	EDS	IL No. 6 (Monterey Mine)	40	One tpd pilot plant, heavy distillate[‡]	104
		IL No. 6	25	One tpd pilot plant, heavy distillate[‡]	99
		Wyodak	45	One tpd pilot plant, heavy distillate[§]	99
		Wyodak	75	One tpd pilot plant, heavy distillate[#]	99
	H-Coal	IL No. 6	86	650-975°F heavy distillate from PDU, syncrude mode	98
		IL No. 6	50	Heavy distillate from PDU, syncrude mode	109
		Wyodak	90	Heavy distillate from PDU, syncrude mode	109
		W. KY No. 11	70	Heavy distillate from PDU, syncrude mode	109
		IL No. 6	115*	Heavy distillate from PDU Run 8, suncrude mode	109

(Continued)

Table 319 (Concluded)

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	H-Coal	IL No. 6	75	650-975°F heavy distillate from PDU Run 5, Run 130-82, Period 29**	111
		Wyodak	95	650-975°F heavy distillate from PDU Run 6, Run 130-83, Period 17††	112
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydrotreated heavy distillates (heavy fuel oils) and residua	NA	--	--	--	--

Explanatory Notes

*Determined via ASTM D-97.

†The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

‡A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F$^+$.

§A full range (350 to 1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw process solvent.

#A blend of raw naphtha, vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 350°F$^+$.

**See Part IX, General Comments section, Note 4, for summary of operating conditions used.

††See Part IX, General Comments section, Note 5, for summary of operating conditions used.

Table 320. Carbon Residue

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	7.2*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)†	82
		KY No. 9	3.4*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)†	82
		KY No. 9	0.012*	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1942CB-1)†	82
		KY No. 9	0.006*	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)†	82
		KY No. 9	57.0*,‡	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	50.74*,‡	Wilsonville pilot plant, heavy SRC (Run No. 220. APCI Sample No. 1916CB)	116
		KY No. 9	52.46*,‡	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
		KY No. 9	55.3*,‡	Wilsonville pilot plant, heavy SRC (Run No. 235, APCI Sample No. 1982CB)	117
		NA	56.5‡	Wilsonville pilot plant heavy SRC (Catalytic Inc. Sample No. SN-2651, Run No. 6, Drum No. 120, Babcock & Wilcox Sample No. C-13994)	120

(Continued)

Table 320 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	NA	53.1[‡]	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run No. 7D, Drum No. 97, Babcock & Wilcox Sample No. C-13995)	120
	SRC-II	NA	2.15[‡]	Ft. Lewis pilot plant, heavy distillate	84
		NA	0.85[‡]	Ft. Lewis pilot plant, heavy distillate	84
		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	0.81[§]	400°F^{+} distillate, Ft. Lewis pilot plant, Chevron Sample No. WOW-3751	86
	EDS	IL No. 6	6.60[‡]	One tpd pilot plant, heavy distillate, as received[#]	123
		IL No. 6	0.95[‡]	One tpd pilot plant, rerun heavy distillate[#]	123
		IL No. 6	3.6[‡]	One tpd pilot plant, heavy distillate[**]	99
		IL No. 6	10.0[‡]	One tpd pilot plant, heavy distillate[#]	99
		IL No. 6	4.02[‡]	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-1[**]	99
		IL No. 6	3.84[‡]	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-2[**]	99

(Continued)

Table 320 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	3.55[‡]	One tpd pilot plant, heavy distillate, UOP Sample No. 3523-3[**]	99
		Wyodak	3.85[‡]	One tpd pilot plant, heavy distillate[††]	99
		Wyodak	17.0[‡]	One tpd pilot plant, heavy distillate[‡‡]	99
		IL No. 6	57.0	One tpd pilot plant, residuum (flexicoker vacuum bottoms)	124
	H-Coal	IL No. 6	4.4[§]	650-975°F heavy distillate from PDU, syncrude mode	98
		IL No. 6	25.9[*,‡]	Heavy distillate from PDU Run 8, syncrude mode	109
		IL No. 6	9.2[§]	650-975°F heavy distillate from PDU Run 5, Run 130-82, Period 29[§§]	111
		Wyodak	3.8[§]	650-975°F heavy distillate from PDU Run 6, Run 130-83, Period 17[##]	112
		NA	0.41	400°F$^+$ fuel oil product from PDU, as received	123
		NA	<0.01	400°F$^+$ fuel oil product from PDU, rerun	123
		IL No. 6	70.2[§]	975°F$^+$ residue from PDU Run 5, Run 130-82, Period 29[§§]	111
		Wyodak	70.1[§]	975°F$^+$ residue from PDU Run 6, Run 130-83, Period 17[##]	112

(Continued)

Table 320 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	37.2[‡]	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116
		KY No. 9	44.1[‡]	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116
	EDS	IL No. 6	0.08[‡]	From first stage hydrocracking of UOP raw 400°F$^+$ heavy distillate Sample No. 3532-3[**] (UOP Sample No. 3532-9)	99

Explanatory Notes

[*] Determined via ASTM D-189

[†] The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

[‡] Conradson carbon residue.

[§] Ramsbottom carbon.

[#] A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F$^+$.

[**] A blend of raw naphtha, vacuum gas oil, and raw process solvent having a nominal boiling point of 400-1000°F.

[††] A full range (350 to 1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw process solvent.

[‡‡] A blend of raw naphtha, vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 350°F$^+$.

[§§] See Part IX, General Comments Section, Note 4, for summary of operating conditions used.

[##] See Part IX, General Comments Section, Note 5, for summary of operating conditions used.

Table 321. Bottom Sediment and Water

Material	Process	Coal Type	Value (ml)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	0.05[*]	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)[†]	82
		KY No. 9	4.5[*]	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)[†]	82
		KY No. 9	0.05[*]	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1942CB-1)[†]	82
		KY No. 9	NA[*] (Not enough sample for analysis)	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)[†]	82
	SRC-II	Pittsburg No. 8 (Powhattan Mine)	1.5	Ft. Lewis pilot plant, heavy distillate	101
	EDS	Wyodak	0.13[‡]	One tpd pilot plant, heavy distillate[§]	101
	H-Coal	NA	0.60	400-900°F heavy distillate from PDU	101
		IL No. 6	NA[#]	Heavy distillate from PDU Run 8, syncrude mode	109
Coal raw heavy distillate blends (heavy fuel oils)	SRC-II	Pittsburg No. 8 (Powhattan Mine)	1.0	0.4/1 middle/heavy distillate blend, Ft. Lewis pilot plant	101

(Continued)

Table 321 (Concluded)

Material	Process	Coal Type	Value (ml)	Sample Description/Source	Reference
Hydrotreated heavy distillate (heavy fuel oils) and residua	NA	--	--	--	--

Explanatory Notes

*Determined via ASTM D-1796.

†The raw heavy distillate from the proposed SRC-I pilot plant will consist of 29.0/71.0/0.0 weight percent blend of heavy distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

‡Moisture determined via ASTM D-95 and sediment determined by hot filtration.

§A full range (350 to 1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw proces solvent.

#Sediment determined by extraction (ASTM D-473) is 30.3 wt percent.

Table 322. Freeze Point

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	104*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)†	82
		KY No. 9	69*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)†	82
		KY No. 9	-17*	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1942CB-1)†	82
		KY No. 9	-13*	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)†	82
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydrotreated heavy distillate (heavy fuel oils) and residua	NA	--	--	--	--

Explanatory Notes

*Determined via ASTM D-2386

†The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

Table 323. Flash Point

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	>230*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)†	82
		KY No. 9	>230*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)†	82
		KY No. 9	>230*	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1942CB-1)†	82
		KY No. 9	>230*	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)†	82
		KY No. 9	No flash point, heavy vapors at 572°F‡	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	No flash point, heavy vapors at 572°F‡	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	No flash point, heavy vapors at 572°F‡	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
		NA	360	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run No. 6, Drum No. 120, Babcock & Wilcox Sample No. C-13994)	120

(Continued)

Table 323 (Continued)

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	NA	360	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run No. 7D, Drum No. 97, Babcock & Wilcox Sample No. C-13995)	120
	SRC-II	Pittsburg No. 8 (Powhattan Mine)	265	Ft. Lewis pilot plant, heavy distillate	101
		NA	285	Ft. Lewis pilot plant, heavy distillate	84
		NA	290	Ft. Lewis pilot plant, heavy distillate	84
		Kentucky	168	Ft. Lewis pilot plant, heavy distillate	98
	EDS	IL No. 6 (Monterey Mine)	196	One tpd pilot plant, heavy distillate§	104
		IL No. 6	198	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99
		IL No. 6	196	One tpd pilot plant, 350°F$^+$ distillate blend from "typical" run	99
		Wyodak	172	One tpd pilot plant, heavy distillate#	101
		Wyodak	158	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99
		Wyodak	196	One tpd pilot plant, 350°F$^+$ distillate blend from "typical" run	99
		Wyodak	>415	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99

(Continued)

Table 323 (Concluded)

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	198[**]	One tpd pilot plant, heavy distillate	99
		IL No. 6	204[††]	One tpd pilot plant, heavy distillate	99
		Wyodak	158[‡‡]	One tpd pilot plant, heavy distillate	99
		Wyodak	200[§§]	One tpd pilot plant, heavy distillate	99
	H-Coal	NA	280	400-900°F heavy distillate from PDU	101
Coal raw heavy distillate blends (heavy fuel oils)	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	230	0.4/1 middle/heavy distillate blend, Ft. Lewis pilot plant	101
Hydrotreated heavy distillates (heavy fuel oils) and residua	NA	--	--	--	--

Explanatory Notes

[*] Determined via ASTM D-96.

[†] The raw heavy distillate from the proposed SRC-I pilot plant will consist of 29.0/71.0/0.0 weight percent blend of heavy distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

[‡] Determined via ASTM D-92.

[§] A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F$^+$.

[#] A full range (350 to 1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw process solvent.

[**] A blend of raw naphtha, vacuum gas oil, and raw process solvent having a nominal boiling point of 400-1000°F$^+$.

[††] A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F$^+$.

[‡‡] A full range (350 to 1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw process solvent.

[§§] A blend of raw naphtha, vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 350°F$^+$.

Table 324. Heat of Combustion

Material	Process	Coal Type	Value (Btu/lb)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	16,930*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)†	82
		KY No. 9	16,679*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)†	82
		KY No. 9	18,000*	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1942CB-1)†	82
		KY No. 9	17,572*	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)†	82
		KY No. 9	15,825‡	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	16,021‡	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	15,977‡	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
		NA	13,970 (HHV)	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2440-C	118
		NA	13,670 (HHV)	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2441-C	118

(Continued)

Table 324 (Continued)

Material	Process	Coal Type	Value (Btu/lb)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	NA	15,770.0 (moisture and ash free)	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run . No. 6, Drum No. 120, Babcock & Wilcox Sample No. C-13994)	120
		NA	15,810.0 (moisture and ash free)	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run . No. 70, Drum No. 97, Babcock & Wilcox Sample No. C-13995)	120
		Kentucky	16,000 (HHV)	Heavy SRC	98
		KY No. 9 and 14	16,000 (HHV)	Ft. Lewis pilot plant, heavy SRC	83
	SRC-II	Pittsburg No. 8 (Powhattan Mine)	17,120 (HHV) 16,420 (LHV)	Ft. Lewis pilot plant, heavy distillate	101
		NA	17,259	Ft. Lewis pilot plant, heavy distillate	84
		NA	17,071	Ft. Lewis pilot plant, heavy distillate	84
		Kentucky	17,300 (HHV)	Ft. Lewis pilot plant, 482-860°F heavy distillate	98
		NA	17,050	Ft. Lewis pilot plant, heavy distillate	126
	EDS	IL No. 6 (Monterey Mine)	16,700	One tpd pilot plant, heavy distillate§	104
		IL No. 6	17,122 (HHV)	One tpd pilot plant, heavy distillate§	89
		IL No. 6	17,500	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99

(Continued)

Table 324 (Continued)

Material	Process	Coal Type	Value (Btu/lb)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	16,700	One tpd pilot plant, 350°F[+] distillate blend from "typical" run	99
		Wyodak	17,770 (HHV)	One tpd pilot plant, heavy distillate[#]	101
		Wyodak	17,600	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99
		Wyodak	16,700	One tpd pilot plant, 350°F[+] distillate blend from "typical" run	99
		Wyodak	12,300	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
		IL No. 6	11,400	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
	H-Coal	NA	17,860 (HHV) 17,030 (LHV)	400-900°F heavy distillate from PDU	101
		IL No. 6	17,420	Heavy distillate from PDU, syncrude mode	109
		Wyodak	17,849	Heavy distillate from PDU, syncrude mode	109
		W. KY No. 11	17,261	Heavy distillate from PDU, syncrude mode	109
		IL No. 6	16,847**	Heavy distillate from PDU, Run 8 syncrude mode	109
		IL No. 6	16,742	650-975°F heavy distillate from PDU Run 5, Run 130-82, Period 29[††]	111
		Wyodak	17,486	650-975°F heavy distillate from PDU Run 6, Run 130-83, Period 17[‡‡]	112

(Continued)

Table 324 (Continued)

Material	Process	Coal Type	Value (Btu/lb)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	H-Coal	IL No. 6	16,225	975°F distillate from PDU Run 6, Run 130-83, Period 17‡‡	112
		IL No. 6	16,108	975°F$^+$ residue from PDU Run 5, 130-82, Period 29	111
Coal raw heavy distillate blends (heavy fuel oils)	SRC-II	Pittsburg No. 8 (Powhattan Mine)	17,000 (HHV) 16,260 (LHV)	0.4/1 middle/heavy distillate blend, Ft. Lewis pilot plant	101
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	16,993	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116
		KY No. 9	16,878	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116
		KY No. 9	16,870	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of SRC hydrocracker (H-Oil) unit. (Wilsonville Run No. 235, APCI Sample No. 1983CB)	117
		KY No. 9	16,175	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of SRC hydrocracker (H-Oil) unit. (Wilsonville Run No. 235, APCI Sample No. 1991CB)	117

(Continued)

Table 324 (Concluded)

Material	Process	Coal Type	Value (Btu/lb)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	18,112 (HHV)	Hydrotreated 400°F+ distillate from one tpd pilot plant§	89

Explanatory Notes

*Determined via ASTM D-240.

†The raw heavy distillate from the proposed SRC-I pilot plant will consist of 29.0/71.0/0.0 weight percent blend of heavy distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

‡Determined via ASTM D-2015.

§A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F+.

#A full range (350 to 1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw process solvent.

**Determined via ASTM D-2382.

††See Part IX, General Comments section, Note 4, for summary of operating conditions used.

‡‡See Part IX, General Comments Section, Note 5, for summary of operating conditions used.

Table 325. Bromine Number

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	69	400°F+ distillate, Ft. Lewis pilot plant, Chevron Sample No. WOW-3751	86
	EDS	IL No. 6	7.2	One tpd pilot plant, heavy distillate[*]	99
		IL No. 6	40.2	One tpd pilot plant, heavy distillate[†]	99
		Wyodak	22.6	One tpd pilot plant, heavy distillate[‡]	99
		Wyodak	54.6	One tpd pilot plant, heavy distillate[§]	99
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydrotreated heavy distillates (heavy fuel oils) and residua	NA	--	--	--	--

(Continued)

Table 325 (Concluded)

Explanatory Notes

[*] A blend of raw naphtha, vacuum gas oil, and raw process solvent having a nominal boiling point of 400-1000°F^{+}.

[†] A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F^{+}.

[‡] A full range (350 to 1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw process solvent.

[§] A blend of raw naphtha, vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 350°F^{+}.

Table 326. Copper Strip Corrosion

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	1a*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)†	82
		KY No. 9	1a*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)†	82
		KY No. 9	1a*	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1942CB-1)†	82
		KY No. 9	1a*	Wilsonville pilot plant heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)†	82
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydro-treated heavy distillates (heavy fuel oils) and residua	NA	--	--	--	--

Explanatory Notes

*Determined via ASTM D-130.

†The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

Table 327. Moisture

Material	Process	Coal Type	Value (Wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	0.12*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)†	82
		KY No. 9	0.11*	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)†	82
		KY No. 9	0.03*	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1942CB-1)†	82
		KY No. 9	0.05*	Wilsonville pilot plant heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)†	82
		KY No. 9	0.06†	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	0.10†	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	0.11†	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
		NA	0.4	Wilsonville pilot plant heavy SRC, C-E Sample No. 2440-C	118
		NA	0.3	Wilsonville pilot plant heavy SRC, C-E Sample No. 2441-C	118

(Continued)

Table 327 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	0.01	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116
		KY No. 9	0.08	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116

Explanatory Notes

*Determined via Karl Fischer method.

†The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillates from the SRC, LC-Finer and coker units, respectively (Reference 100).

‡Determined via ASTM D-3302.

Table 328. Sintering Temperature

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	228.2	Wilsonville pilot plant, heavy SRC (Run No 225, APCI Sample No 1914CB)	116
		KY No. 9	199.4	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	215.6	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydro-treated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	202	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1991CB)	117

Table 329. Melting (Fusion) Point

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	320	Wilsonville pilot plant heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	275	Wilsonville pilot plant heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	293	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
		KY No. 9 and 14	324	Ft Lewis pilot plant, heavy SRC	83
		NA	330-350	Heavy SRC	98
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydro-treated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	253	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1991CB)	117

Table 330. Softening Point

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	356	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	310	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	332	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
		KY No. 9	338	Wilsonville pilot plant, heavy SRC (Run No. 235, APCI Sample No. 1982CB)	117
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	318	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116
		KY No. 9	325	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116
	H-Coal	IL No. 6	360	975°F+ residue from PDU Run 5, Run 130-82, Period 29*	111
		Wyodak	350	975°F+ residue from PDU Run 6, Run 130-83, Period 17†	112

Explanatory Notes

*See Part IX, General Comments Section, Note 4, for summary of operating conditions used.

†See Part IX, General Comments Section, Note 5, for summary of operating conditions used.

Table 331. Free Swelling Index

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	1*	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	1/2*	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	1*	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydro-treated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	1/2*	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116
		KY No. 9	1/2*	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116
		KY No. 9	1	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1983CB)	117

(Continued)

Table 331 (Concluded)

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	1	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1991CB)	117

Explanatory Note

*Determined via ASTM D-720

Table 332. Heat Capacity

Material	Process	Coal Type	Value (Btu/ lb/ °F)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	0.37	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	0.43	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	0.36	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
		KY No. 9 and 14	0.319 (100°F) 0.494 (400°F) 0.557 (700°F)	Ft. Lewis pilot plant, heavy SRC	83
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydro-treated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	0.42 (212°F) 0.56 (392°F) 0.74 (572°F) 0.55 (752°F)	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116,117
		KY No. 9	0.38 (212°F) 0.50 (392°F) 0.65 (572°F) 0.55 (752°F)	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116,117

(Continued)

Table 332 (Concluded)

Material	Process	Coal Type	Value (Btu/ lb/ °F)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	0.35 (212°F) 0.46 (392°F) 0.51 (572°F) 0.60 (752°F)	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1991CB)	117

Table 333. Ash Content (by Proximate Analysis)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	0.039	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	0.044	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	0.044	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
		NA	0.2	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2440-C	118
		NA	0.1	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2441-C	118
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	0.019	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116
		KY No. 9	0.019	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116

(Continued)

Table 333 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua		KY No. 9	0.12	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1983CB)	117
		KY No. 9	0.08	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1991CB)	117

Table 334. Volatiles Content

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	63.30	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	68.17	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	60.22	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
		NA	64.4	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2440-C	118
		NA	61.9	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2441-C	118
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	76.40	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116
		KY No. 9	74.70	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116

(Continued)

Table 334 (Concluded)

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	27.29	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1983CB)	117
		KY No. 9	73.90	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1991CB)	117

Table 335. Fixed Carbon

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	36.60	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	31.71	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	39.47	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
		NA	25.7	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2440-C	118
		NA	26.0	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2441-C	118
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydro-treated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	23.71	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116
		KY No. 9	25.20	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116

(Continued)

Table 335 (Concluded)

Material	Process	Coal Type	Value (°F)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	72.59	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1983CB)	117
		KY No. 9	26.02	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1991CB)	117

Table 336. Oxygen Content

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	3.33	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)*	82
		KY No. 9	2.75	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)*	82
		KY No. 9	0.15	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC-Finer-29, APCI Sample No. 1942CB-1)*	82
		KY No. 9	<0.1	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)*	82
		KY No. 9	2.25	Wilsonville pilot plant, heavy distillate from Alcoa coker unit (APCI Sample No. 1899CB)	82
		KY No. 9	4.28	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	3.98	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	3.71	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
		NA	3.3	Wilsonville pilot plant, heavy SRC	119
		NA	4.0†	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2440-C	118

(Continued)

Table 336 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	NA	5.1[†]	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2441-C	118
		Kentucky	4.3	Heavy SRC	98
		IL No. 6	5.00	Wilsonville pilot plant, heavy SRC	145
		KY No. 9 and 14	3.93	Ft. Lewis pilot plant, heavy SRC	83
	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	1.9	Ft. Lewis pilot plant, heavy distillate	101
		NA	2.04	Ft. Lewis pilot plant, heavy distillate	84
		NA	1.80	Ft. Lewis pilot plant, heavy distillate	84
		Kentucky	2.5-3.6	Ft. Lewis pilot plant, 482-860°F heavy distillate	98
		NA	1.6[†]	Ft. Lewis pilot plant, heavy distillate	126
		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	3.63	400°F$^+$ distillate, Ft. Lewis pilot plant, Chevron Sample No. WOW-3751	86
	EDS	IL No. 6	1.83	One tpd pilot plant, heavy distillate[‡]	89
		Wyodak	1.59	One tpd pilot plant, heavy distillate[§]	101

(Continued)

Table 336 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	1.93	One tpd pilot plant, heavy distillate, as received[‡]	123
		IL No. 6	2.84	One tpd pilot plant, rerun heavy distillate[‡]	123
		IL No. 6	2.6[†]	One tpd pilot plant, heavy distillate[#]	99
		IL No. 6	3.1	One tpd pilot plant heavy distillate[‡]	99
		IL No. 6	2.9	One tpd pilot plant, heavy distillate[#]	99
		IL No. 6	0.9100	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-1[#]	99
		IL No. 6	2.8000	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-2[#]	99
		IL No. 6	1.9800	One tpd pilot plant, heavy distillate, UOP Sample No. 3523-3[#]	99
		IL No. 6	1.90	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99
		IL No. 6	2.51	One tpd pilot plant, 350°F$^+$ distillate blend from "typical" run	99
		Wyodak	2.6	One tpd pilot plant, heavy distillate[§]	99
		Wyodak	2.4	One tpd pilot plant, heavy distillate[**]	99
		Wyodak	2.9	One tpd pilot plant, heavy distillate[**]	99

(Continued)

Table 336 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	Wyodak	2.60	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99
		Wyodak	2.90	One tpd pilot plant, 350°F+ distillate blend from "typical" run	99
	EDS	IL No. 6	2.42	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
		IL No. 6 (Monterey Mine)	3.24±0.45	One tpd pilot plant, vacuum bottoms, average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	2.42±0.58	One tpd pilot plant, vacuum bottoms; operating conditions: 840°F reactor temperature, 40 minutes residence time, average of ten yield periods	99
		IL No. 6 (Monterey Mine)	2.44±0.80	75 lb per day development unit, vacuum bottoms; average of six operating conditions (800-880°F reactor temperature; 25-100 minutes residence time)	99
		IL No. 6 (Monterey Mine)	1.92±0.53	75 lb per day development unit, vacuum bottoms; operating conditions: 840°F reactor temperature; 40 minutes residence time, average of 21 yield periods	99

(Continued)

Table 336 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	Wyodak	3.86	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
		Wyodak	4.30±0.90	One tpd pilot plant, vacuum bottoms, average of six operating conditions (800-840°F reactor temperature; 40-100 minutes residence time)	99
	EDS	Wyodak	3.86±0.77	One tpd pilot plant, vacuum bottoms; operating conditions: 840°F reactor temperature; 60 minutes residence time, average of seven yield periods	99
		Wyodak	3.37±1.33	75 lb-per day development unit, vacuum bottoms, average of eight operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		Wyodak	2.26±0.43	75 lb per day development unit, vacuum bottoms; operating conditions: 880°F reactor temperature, 25 minutes residence time, average of six yield periods	99
		NA	3.59	One tpd pilot plant, vacuum bottoms (DuPont "Notebook" Sample No. 16928)	91
	H-Coal	NA	1.68†	400-900°F heavy distillate from PDU	101
		IL No. 6	1.3	Heavy distillate from PDU, syncrude mode	109
		Wyodak	1.6	Heavy distillate from PDU, syncrude mode	109

(Continued)

Table 336 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	H-Coal	W.KY No. 11	2.2	Heavy distillate from PDU, syncrude mode	109
		NA	0.84[†]	400°F$^+$ fuel oil product from PDU; operating conditions: 851°F, 2,500 psig	154
		IL No. 6	1.20	650-975°F heavy distillate from PDU, syncrude mode	98
	H-Coal	IL No. 6	0.97	650-975°F heavy distillate from PDU Run 5, Run 130-82, Period 29[††]	111
		Wyodak	2.00	650-975°F heavy distillate from PDU Run 6, Run 130-83, Period 17[††]	112
		IL No. 6	1.37	975°F$^+$ residue from PDU Run 5, Run 130-82, period 29[††]	111
		Wyodak	2.85	975°F$^+$ residue from PDU Run 6, Run 130-83, Period 17[††]	112
Coal raw heavy distillate blends (heavy fuel oils)	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	3.47[†]	0.4/1 middle/heavy distillate blend, Ft. Lewis pilot plant	101
		NA	1.3[†]	1/2 middle/heavy distillate blend, Ft. Lewis pilot plant	126
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	1.16	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116

((Continued)

Table 336 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-1	KY No. 9	0.72	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116
		KY No. 9	1.61	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1983CB)	117
		KY No. 9	2.24	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1991CB)	117
		IL No. 6	0.32	Hydrotreated 400°F$^+$ distillate from one tpd pilot plant†	89
	EDS	IL No. 6	0.2980	From first stage hydrocracking of UDP raw 400°F$^+$ heavy distillate Sample No. 3532-3$^\#$ (UOP Sample No. 3532-9)	99
		IL No. 6	0.0167	From first stage hydrocracking of UDP raw 400°F$^+$ heavy distillate Sample No. 3532-2$^\#$ (UOP Sample No. 3532-4)	99
		IL No. 6	0.0226	From second stage hydrocracking of UOP hydrocracked Sample No. 3532-4 (UDP Sample No. 3532-17)	99

(Continued)

Table 336 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	0.0197	From second state hydrocracking of UOP hydrocracked Sample No. 3532-4 (UOP Sample No. 3532-18)	99
	H-Coal	IL No. 6	0.94	PDU, fuel oil mode, from low severity hydrotreatment of 375-1000°F distillate (DOE Sample No. 1617)	151
	H-Coal	IL No. 6	0.74	PDU, fuel oil mode, from medium severity hydrotreatment of 375-1000°F distillate (DOE Sample No. 1618)	151
		IL No. 6	0.44	PDU, fuel oil mode, from high severity treatment of 375-1000°F distillate (DOE Sample No. 1619)	151

Explanatory Notes

*The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillate from the SRC, LC Finer and coker units, respectively (Reference 100).

†By difference.

‡A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F$^+$.

§A full range (350 to 1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw process solvent.

#A blend of raw naphtha, vacuum gas oil, and raw process solvent having a nominal boiling point of 400-1000°F.

**A blend of raw naphtha, vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 350°F$^+$.

††See Part IX, General Comments section, Note 4, for summary of operating conditions used.

‡‡See Part IX, General Comments section, Note 5, for summary of operating conditions used.

Table 337. Sulfur Content

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	0.61	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)*	82
		KY No. 9	0.56	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1919CB)*	82
		KY No. 9	0.01	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC-Finer-29, APCI Sample No. 1942CB-1)*	82
		KY No. 9	<0.01	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)*	82
		KY No. 9	0.47	Wilsonville pilot plant, heavy distillate from Alcoa coker unit (APCI Sample No. 1899CB)	82
		KY No. 9	1.12	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	1.12	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	1.04	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
		NA	0.85	Wilsonville pilot plant, heavy SRC	119
		NA	0.8	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2440-C	118
		NA	0.7	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2441-C	118
		Kentucky	0.7-0.8	Heavy SRC	98

(Continued)

Table 337 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residue	SRC-I	NA	0.9†	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run No. 6, Drum No. 120, Babcock and Wilcox Sample No. C-13994)	120
		NA	0.7†	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run No. 7D, Drum No. 97, Babcock and Wilcox Sample No. C-13995)	120
		IL No. 6	0.67	Wilsonville pilot plant, heavy SRC	145
		KY No. 9 and 14	0.75	Ft. Lewis pilot plant, heavy SRC	83
	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	0.39	Ft. Lewis pilot plant, heavy distillate	101
		NA	0.42	Ft. Lewis pilot plant, heavy distillate	84
		NA	0.35	Ft. Lewis pilot plant, heavy distillate	84
		Kentucky	0.2-0.4	Ft. Lewis pilot plant, 482-860°F heavy distillate	98
		NA	0.5	Ft. Lewis pilot plant, heavy distillate	126
		KY No. 9 and 14, IL No. 6 (King River Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	0.25	400°F$^+$ distillate, Ft. Lewis pilot plant, Chevron Sample No. WOW-3751	86

(Continued)

Table 337 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6 (Monterey Mine)	0.8	One tpd pilot plant, heavy distillate[‡]	104
		IL No. 6	0.41	One tpd pilot plant, heavy distillate[‡]	89
		Wyodak	0.29	One tpd pilot plant, heavy distillate[§]	101
		IL No. 6	0.49	One tpd pilot plant, heavy distillate, as received[‡]	123
		IL No. 6	0.20	One tpd pilot plant, rerun heavy distillate[‡]	123
		IL No. 6	0.60	One tpd pilot plant, heavy distillate[#]	99
		IL No. 6	0.54	One tpd pilot plant, heavy distillate[#]	99
		IL No. 6	0.87	One tpd pilot plant, heavy distillate[‡]	99
		IL No. 6	0.6500	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-1[#]	99
		IL No. 6	0.6710	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-2[#]	99
		IL No. 6	0.6510	One tpd pilot plant, heavy distillate, UOP Sample No. 3523-3[#]	99
		IL No. 6	0.38	One tpd pilot plant, 350 to 1000°F distillate belnd from "typical" run	99
		IL No. 6	0.60	One tpd pilot plant, 350°F^{+} distillate blend from "typical" run	99

(Continued)

Table 337 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	Wyodak	0.10	One tpd pilot plant, heavy distillate[§]	99
		Wyodak	0.18	One tpd pilot plant, heavy distillate[**]	99
		Wyodak	0.15	One tpd pilot plant, heavy distillate[**]	99
		Wyodak	0.10	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99
		Wyodak	0.15	One tpd pilot plant, 350°F^{+} distillate blend from "typical" run	99
		IL No. 6	2.3	One tpd pilot plant, residuum (flexicoker vacuum bottoms)	124
		IL No. 6	2.30	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
		IL No. 6 (Monterey Mine)	2.37±0.07	One tpd pilot plant, vacuum bottoms, average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	2.30±0.10	One tpd pilot plant, vacuum bottoms; operating conditions: 840°F reactor temperature; 40 minutes residence time, average of ten yield periods	99
		IL No. 6 (Monterey Mine)	2.24±0.15	75 lb per day development unit, vacuum bottoms; average of six operating conditions (800-880°F reactor temperature; 25-100 minutes residence time)	99

(Continued)

Table 337 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residue	EDS	IL No. 6 (Monterey Mine)	2.48±0.17	75 lb per day development unit, vacuum bottoms; operating conditions: 840°F reactor temperature, 40 minutes residence time, average of 21 yield periods	99
		Wyodak	0.34	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
		Wyodak	0.39±0.06	One tpd pilot plant, vacuum bottoms; operating conditions: 800-840°F reactor temperature; 40-100 minutes residence time	99
		Wyodak	0.34±0.11	One tpd pilot plant, vacuum bottoms; operating conditions: 840°F reactor temperature; 60 minutes residence time, average of seven yield periods	99
		Wyodak	0.54±0.14	75 lb per day development unit, vacuum bottoms, average of eight operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		Wyodak	0.60±0.09	75 lb per day development unit, vacuum bottoms; operating conditions: 880°F reactor temperature, 25 minutes residence time, average of six yield periods	99
		NA	1.22	One tpd pilot plant, vacuum bottoms (DuPont "Notebook" Sample No. 16928)	91

(Continued)

Table 337 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	H-Coal	NA	0.075	400-900°F heavy distillate from PDU	101
		IL No. 6	0.2	Heavy distillate from PDU, syncrude mode	109
		Wyodak	0.2	Heavy distillate from PDU, syncrude mode	109
		W.Ky No. 11	0.2	Heavy distillate from PDU, syncrude mode	109
		IL No. 6 (Burning Star Mine)	0.1500	Heavy distillate from PDU (Ashland Oil Sample)	96
		IL No. 6	0.22	650-975°F heavy distillate from PDU, syncrude mode	98
		IL No. 6	0.14	650-975°F heavy distillate from PDU Run 5, Run 130-82, Period 29[††]	111
		Wyodak	<0.03	650-975°F heavy distillate from PDU Run 6, Run 130-83, Period 17[‡‡]	112
		IL No. 6	0.37	975°F$^+$ residue from PDU Run 5, Run 130-82, Period 29[††]	111
		Wyodak	0.13	975°F$^+$ residue from PDU Run 6, Run 130-82, Period 17[‡‡]	112
		NA	0.19	PDU, heavy distillate	153
		NA	0.16	PDU, heavy distillate	153
		NA	0.14	400°F$^+$ fuel oil product from PDU; operating conditions: 851°F, 2500 psig	154

(Continued)

Table 337 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	H-Coal	NA	0.10	400°F$^+$ fuel oil product from PDU, as received	123
		NA	0.08	400°F$^+$ fuel oil product from PDU, rerun	123
Coal raw heavy distillate blends (heavy fuel oils)	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	0.34	0.4/1 middle/heavy distillate blend, Ft. Lewis pilot plant	101
		NA	0.4	Ft. Lewis pilot plant, 1/2 middle/heavy distillate blend	126
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	0.21	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116
		KY No. 9	0.05	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116
		KY No. 9	0.28	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of SRC hydrocracker (H-Oil) unit. (Wilsonville Run No. 235, APCI Sample No. 1983CB)	117

(Continued)

Table 337 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	0.33	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1991CB)	117
		IL No. 6	0.04	Hydrotreated 400°F$^+$ distillate from one tpd pilot plant[‡]	89
	EDS	IL No. 6	0.0267	From first stage hydrocracking of UOP raw 400°F$^+$ heavy distillate Sample No. 3532-3[#] (UOP Sample No. 3532-9)	99
		IL No. 6	0.0013	From first stage hydrocracking of UOP raw 400°F$^+$ heavy distillate Sample No. 3532-2[#] (UOP Sample No. 3532-4)	99
		IL No. 6	0.0365	From second stage hydrocracking of UOP hydrocracked Sample No. 3532-4	99
		IL No. 6	0.0261	From second stage hydrocracking of UOP hydrocracked Sample No. 3532-4 (UOP Sample No. 3532-18)	99
		IL No. 6	0.059	PDU, fuel oil mode, from low severity hydrotreatment of 375-1000°F distillate (DOE Sample No. 1617)	151
		IL No. 6	0.039	PDU, fuel oil mode, from medium severity hydrotreatment of 375-1000°F distillate (DOE Sample No. 1618)	151
		IL No. 6	0.011	PDU, fuel oil mode, from high severity hydrotreatment of 375-1000°F distillate (DOE Sample No. 1619)	151

(Continued)

Table 337 (Concluded)

Explanatory Notes

*The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillate from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined using solid fuel ASTM procedures.

‡A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F$^+$.

§A full range (350 to 1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw process solvent.

#A blend of raw naphtha, vacuum gas oil, and raw process solvent having a nominal boiling point of 400-1000°F.

**A blend of raw naphtha, vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 350°F$^+$.

††See Part IX, General Comments section, Note 4, for summary of operating conditions used.

‡‡See Part IX, General Comments section, Note 5, for summary of operating conditions used.

Table 338. Nitrogen Content

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	0.96	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)*	82
		KY No. 9	1.18	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)*	82
		KY No. 9	0.22	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC-Finer-29, APCI Sample No. 1942CB-1)*	82
		KY No. 9	0.29	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)	82
		KY No. 9	1.29	Wilsonville pilot plant, heavy distillate from Alcoa coker unit (APCI Sample No. 1899CB)	82
		KY No. 9	2.17	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	2.09	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	2.07	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
		NA	1.97	Wilsonville pilot plant, heavy SRC	119
		NA	1.5	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2440-C	118
		NA	1.6	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2441-C	118
		Kentucky	2.1-2.2	Heavy SRC	98

(Continued)

Table 338 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	NA	1.8†	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run No. 6, Drum No. 120, Babcock and Wilcox Sample No. C-13994)	120
		NA	2.0†	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run No. 7b, Drum No. 97, Babcock and Wilcox Sample No. C-13995)	120
		IL No. 6	2.00	Wilsonville pilot plant, heavy SRC	145
		KY No. 9 and 14	2.15	Ft. Lewis pilot plant, heavy SRC	83
	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	1.03	Ft. Lewis pilot plant, heavy distillate	101
		NA	0.98	Ft. Lewis pilot plant, heavy distillate	84
		NA	0.94	Ft. Lewis pilot plant, heavy distillate	84
		Kentucky	1.1-1.4	Ft. Lewis pilot plant, 482-860°F heavy distillate	98
		NA	1.1	Ft. Lewis pilot plant, heavy distillate	126
		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	0.99	400°F+ distillate, Ft. Lewis pilot plant, Chevron Sample No. WOW-3751	86

(Continued)

Table 338 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6 (Monterey Mine)	1.0	One tpd pilot plant, heavy distillate[‡]	104
		IL No. 6	0.66	One tpd pilot plant, heavy distillate[‡]	89
		Wyodak	0.39	One tpd pilot plant, heavy distillate[§]	101
		IL No. 6	0.71	One tpd pilot plant, heavy distillate, as received[‡]	123
		IL No. 6	0.49	One tpd pilot plant, rerun heavy distillate[‡]	123
		IL No. 6	0.55	One tpd pilot plant, heavy distillate[#]	99
		IL No. 6	0.62	One tpd pilot plant, heavy distillate[#]	99
		IL No. 6	0.80	One tpd pilot plant, heavy distillate[‡]	99
		IL No. 6	0.4580	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-1[#]	99
		IL No. 6	0.4950	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-2[#]	99
		IL No. 6	0.5050	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-3[#]	99
		IL No. 6	0.49	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99
		IL No. 6	0.77	One tpd pilot plant, 350°F$^+$ distillate blend from "typical" run	99

(Continued)

Table 338 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	Wyodak	0.44	One tpd pilot plant, heavy distillate[§]	99
		Wyodak	0.86	One tpd pilot plant, heavy distillate**	99
		Wyodak	0.89	One tpd pilot plant, heavy distillate**	99
		Wyodak	0.48	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99
		Wyodak	0.89	One tpd pilot plant, 350°F^{+} distillate from "typical" run	99
		IL No. 6	1.5	One tpd pilot plant, residuum (flexicoker vacuum bottoms)	124
		IL No. 6	1.45	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
		IL No. 6 (Monterey Mine)	1.29±0.28	One tpd pilot plant, vacuum bottoms, average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	1.45±0.04	One tpd pilot plant, vacuum bottoms; operating conditions: 840°F reactor temperature; 40 minutes residence time, average of ten yield periods	99
		IL No. 6 (Monterey Mine)	1.39±0.07	75 lb per day development unit, vacuum bottoms; average of six operating conditions (800-880°F reactor temperature; 25-100 minutes residence time)	99

(Continued)

Table 338 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6 (Monterey Mine)	1.35±0.09	75 lb per day development unit, vacuum bottoms; operating conditions: 840°F reactor temperature, 40 minutes residence time, average of 21 yield periods	99
		Wyodak	1.04	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
		Wyodak	1.18±0.12	One tpd pilot plant, vacuum bottoms, average of six operating conditions (800-840°F reactor temperature; 40-100 minutes residence time)	99
		Wyodak	1.04±0.08	One tpd pilot plant, vacuum bottoms; operating conditions: 840°F reactor temperature; 60 minutes residence time, average of seven yield periods	99
		Wyodak	1.19±0.05	75 lb per day development unit, vacuum bottoms; average of eight operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		Wyodak	1.16±0.05	75 lb per day development unit, vacuum bottoms; operating conditions: 880°F reactor temperature, 25 minutes residence time, average of six yield periods	99
		NA	1.31	One tpd pilot plant, vacuum bottoms (DuPont "Notebook" Sample No. 16928)	91

(Continued)

Table 338 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	H-Coal	NA	0.57	400-900°F heavy distillate from PDU	101
		IL No. 6	1.3	Heavy distillate from PDU, syncrude mode	109
		Wyodak	1.4	Heavy distillate from PDU, syncrude mode	109
		W.KY No. 11	1.2	Heavy distillate from PDU, syncrude mode	109
		IL No. 6 (Burning Star Mine)	0.3600	Heavy distillate from PDU (Ashland Oil Sample)	96
		IL No. 6	1.01	650-975°F heavy distillate from PDU, syncrude mode	98
		IL No. 6	1.10	650-975°F heavy distillate from PDU Run 5, Run 130-82, Period 29[††]	111
		Wyodak	1.04	650-975°F heavy distillate from PDU Run 6, Run 130-83, Period 17[‡‡]	112
		IL No. 6	1.95	975°F$^+$ residue from PDU Run 5, Run 130-82, Period 29[††]	111
		Wyodak	1.20	975°F$^+$ residue from PDU Run 6, Run 130-82, Period 17[‡‡]	112
		IL No. 6	0.68	PDU, heavy distillate	153
		Wyodak	0.64	PDU, heavy distillate	153
		NA	0.87	400°F$^+$ fuel oil product from PDU; operating conditions: 851°F, 2500 psig	154
		NA	0.35	400°F$^+$ fuel oil product from PDU, as received	123
		NA	0.41	400°F$^+$ fuel oil product from PDU, rerun	123

(Continued)

Table 338 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillate blends (heavy fuel oils)	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	0.96	0.4/1 middle/heavy distillate blend, Ft. Lewis pilot plant	101
		NA	1.0	Ft. Lewis pilot plant, 1/2 middle/heavy distillate blend	126
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	1.00	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116
		KY No. 9	1.10	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116
		KY No. 9	1.85	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of SRC hydrocracker (H-Oil) unit. (Wilsonville Run No. 235, APCI Sample No. 1983CB)	117
		KY No. 9	1.85	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1991CB)	117
		IL No. 6	0.24	Hydrotreated 400°F$^+$ distillate from one tpd pilot plant[‡]	89

(Continued)

Table 338 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	0.0844	From first stage hydrocracking of UOP raw 400°F$^+$ heavy distillate Sample No. 3532-3$^\#$ (UOP Sample No. 3532-9)	99
		IL No. 6	0.0007	From first stage hydrocracking of UOP raw 400°F$^+$ heavy distillate Sample No. 3532-2$^\#$ (UOP Sample No. 3532-4)	99
		IL No. 6	0.00002	From second stage hydrocracking of UOP hydrocracked Sample No. 3532-4	99
		IL No. 6	0.00002	From second stage hydrocracking of UOP hydrocracked Sample No. 3532-4 (UOP Sample No. 3532-18)	99
	H-Coal	IL No. 6	0.58	PDU, fuel oil mode, from low severity hydrotreatment of 375-100°F distillate (DOE Sample No. 1617)	151
		IL No. 6	0.55	PDU, fuel oil mode, from medium severity hydrotreatment of 375-100°F distillate (DOE Sample No. 1618)	151
		IL No. 6	0.30	PDU, fuel oil mode, from high severity Hydrotreatment of 375-100°F distillate (DOE Sample No. 1619)	151

(Continued)

Table 338 (Concluded)

Explanatory Notes

*The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillate from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined using solid fuel ASTM procedures.

‡A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F$^+$.

§A full range (350 to 1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw process solvent.

#A blend of raw naphtha, vacuum gas oil, and raw process solvent having a nominal boiling point of 400-1000°F.

**A blend of raw naphtha, vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 350°F$^+$.

††See Part IX, General Comments section, Note 4, for summary of operating conditions used.

‡‡See Part IX, General Comments section, Note 5, for summary of operating conditions used.

Table 339. Carbon Content

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	87.08	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)*	82
		KY No. 9	88.13	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)*	82
		KY No. 9	91.08	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC-Finer-29, APCI Sample No. 1942CB-1)*	82
		KY No. 9	91.62	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)*	82
		KY No. 9	88.34	Wilsonville pilot plant, heavy distillate from Alcoa coker unit (APCI Sample No. 1899CB)	82
		KY No. 9	86.92	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	86.72	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	87.38	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
		IL No. 6	86.90	Wilsonville pilot plant, heavy SRC	145
		NA	78.8	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2440-C	118
		NA	75.3	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2441-C	118
		Kentucky	86.9	Heavy SRC	98

(Continued)

Table 339 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	NA	87.7†	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run No. 6 Drum No. 120, Babcock and Wilcox Sample No. C-13994)	120
		NA	87.1†	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run No. 7D, Drum No. 97, Babcock and Wilcox Sample No. C-13995)	120
		KY No. 9 and 14	87.26	Ft. Lewis pilot plant, heavy SRC	83
	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	88.98	Ft. Lewis pilot plant, heavy distillate	101
		KY No. 9 and 14, IL No. 6 (King River Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	86.61, 86.18	400°F$^+$ distillate, Ft. Lewis pilot plant, Chevron Sample No. WOW-3751	86
		Kentucky	86.8-87.6	Ft. Lewis pilot plant, 482-860°F heavy distillate	98
		NA	88.9	Ft. Lewis pilot plant, heavy distillate	126

(Continued)

Table 339 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	89.40	One tpd pilot plant, heavy distillate[‡]	89
		Wyodak	88.66	One tpd pilot plant, heavy distillate[§]	101
		IL No. 6	89.22	One tpd pilot plant, heavy distillate, as received[‡]	123
		IL No. 6	87.93	One tpd pilot plant, rerun heavy distillate[‡]	123
		IL No. 6	87.98	One tpd pilot plant, heavy distillate[#]	99
		IL No. 6	87.39	One tpd pilot plant, heavy distillate[#]	99
		IL No. 6	87.39	One tpd pilot plant, heavy distillate[‡]	99
		IL No. 6	86.00	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-1[#]	99
		IL No. 6	86.45	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-2[#]	99
		IL No. 6	87.61	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-3[#]	99
		IL No. 6	88.50	One tpd pilot plant, 350 to 1000°F distillate blend	99
		IL No. 6	87.67	One tpd pilot plant, 350°F$^+$ distillate blend	99

(Continued)

Table 339 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	Wyodak	88.58	One tpd pilot plant, heavy distillate§	99
		Wyodak	89.21	One tpd pilot plant, heavy distillate**	99
		Wyodak	88.98	One tpd pilot plant, heavy distillate**	99
		Wyodak	88.69	One tpd pilot plant, 350 to 1000°F distillate blend	99
		Wyodak	88.92	One tpd pilot plant, 350°F+ distillate blend	99
		IL No. 6	69.43	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	124
		IL No. 6 (Monterey Mine)	70.41±0.87	One tpd pilot plant, vacuum bottoms, average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	69.43±0.53	One tpd pilot plant, vacuum bottoms; operating conditions: 840°F reactor temperature; 15-40 minutes residence time, average of ten yield periods	99
		IL No. 6 (Monterey Mine)	71.41±1.74	75 lb per day development unit, vacuum bottoms; average of six operating conditions (800-880°F reactor temperature; 25-100 minutes residence time)	99
		IL No. 6 (Monterey Mine)	68.39±0.97	75 lb per day development unit, vacuum bottoms; operating conditions: 840°F reactor temperature; 40 minutes residence time, average of 21 yield periods	99

(Continued)

Table 339 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	Wyodak	75.87	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
		Wyodak	75.47±1.01	One tpd pilot plant, vacuum bottoms, average of six operating conditions (800-840°F reactor temperature; 40-100 minutes residence time)	99
		Wyodak	75.87±1.42	One tpd pilot plant, vacuum bottoms; operating conditions: 840°F reactor temperature; 60 minutes residence time, average of seven yield periods	99
		Wyodak	75.96±1.62	75 lb per day development unit, vacuum bottoms, average of eight operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		Wyodak	75.59±0.52	75 lb per day development unit, vacuum bottoms; operating conditions: 880°F reactor temperature, 25 minutes residence time, average of six yield periods	99
		NA	85.84	One tpd pilot plant, vacuum bottoms (DuPont "Notebook" Sample No. 16928)	91
	H-Coal	NA	88.52	400-900°F heavy distillate from PDU	101
		IL No. 6	89.2	Heavy distillate from PDU, syncrude mode	109
		Wyodak	86.6	Heavy distillate from PDU, syncrude mode	109
		W.K No. 11	89.0	Heavy distillate from PDU, syncrude mode	109

(Continued)

Table 339 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	H-Coal	NA	89.82	400°F fuel oil product from PDU; operating conditions: 851°F, 2500 psig	151
		IL No. 6	90.0	650-975°F heavy distillate from PDU, syncrude mode	98
		IL No. 6	89.70	650-975°F heavy distillate from PDU Run 5, Run 130-82, Period 29[††]	111
		Wyodak	89.61	650-975°F heavy distillate from PDU Run 6, Run 130-83, Period 17[‡‡]	112
		IL No. 6	88.47	975°F$^+$ residue from PDU Run 5, Run 130-82, Period 29[††]	111
		Wyodak	90.17	975°F$^+$ residue from PDU Run 6, Run 130-83, Period 17[‡‡]	112
		NA	89.32	400°F$^+$ fuel oil product from PDU, rerun	123
Coal raw heavy distillate blends (heavy fuel oils)	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	87.16	0.4/1 middle/heavy distillate blend, Ft. Lewis pilot plant	101
		NA	89.1	Ft. Lewis pilot plant, 1/2 middle/heavy distillate blend	126
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	90.95	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116
		KY No. 9	92.33	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116

(Continued)

Table 339 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	89.61	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1983CB)	117
		KY No. 9	89.37	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1991CB)	117
		IL No. 6	90.80	Hydrotreated $400^\circ F^+$ distillate from one tpd pilot plant[‡]	89
	EDS	IL No. 6	88.58	From first stage hydrocracking of UOP raw $400^\circ F^+$ heavy distillate Sample No. 3532-3[#] (UOP Sample No. 3532-9)	99
		IL No. 6	87.53	From first stage hydrocracking of UOP raw $400^\circ F^+$ heavy distillate Sample No. 3532-2[#] (UOP Sample No. 3532-4)	99
		IL No. 6	86.03	From second stage hydrocracking of UOP hydrocracked Sample No. 3532-4	99
		IL No. 6	86.72	From second stage hydrocracking of UOP hydrocracked Sample No. 3532-4 (UOP Sample No. 3532-18)	99

(Continued)

Table 339 (Concluded)

Explanatory Notes

[*] The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillate from the SRC, LC Finer and coker units, respectively (Reference 100).

[†] Determined using solid fuel ASTM procedures.

[‡] A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F$^+$.

[§] A full range (350 to 1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw process solvent.

[#] A blend of raw naphtha, vacuum gas oil, and raw process solvent having a nominal boiling point of 400-1000°F.

[**] A blend of raw naphtha, vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 350°F$^+$.

[††] See Part IX, General Comments section, Note 4, for summary of operating conditions used.

[‡‡] See Part IX, General Comments section, Note 5, for summary of operating conditions used.

Table 340. Hydrogen Content

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	7.58	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)*	82
		KY No. 9	7.15	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)*	82
		KY No. 9	8.67	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC-Finer-29, APCI Sample No. 1942CB-1)*	82
		KY No. 9	7.50	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)*	82
		KY No. 9	7.03	Wilsonville pilot plant, heavy distillate from Alcoa coker unit (APCI Sample No. 1899CB)	82
		KY No. 9	5.75	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	6.03	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	5.73	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
		NA	5.80	Wilsonville pilot plant, heavy SRC	119
		NA	5.0	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2440-C	118
		NA	5.2	Wilsonville pilot plant, heavy SRC, C-E Sample No. 2441-C	118
		Kentucky	5.8	Heavy SRC	98

(Continued)

Table 340 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	NA	5.5†	Wilsonville pilot plant, (Catalytic Inc. Sample No. SN-2651, Run No. 6, Drum No. 120, Babcock and Wilcox Sample No. C-13994)	120
		NA	5.9†	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run No. 7D, Drum No. 97, Babcock and Wilcox Sample No. C-13995)	120
		IL No. 6	5.75	Wilsonville pilot plant, heavy SRC	145
		KY No. 9 and 14	5.77	Ft. Lewis pilot plant, heavy SRC	83
	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	7.64	Ft. Lewis pilot plant, heavy distillate	101
		NA	7.13	Ft. Lewis pilot plant, heavy distillate	84
		NA	7.22	Ft. Lewis pilot plant, heavy distillate	84
		Kentucky	7.6-8.5	Ft. Lewis pilot plant, 482-860°F heavy distillate	98
		NA	7.3	Ft. Lewis pilot plant heavy distillate	126
		KY No. 9 and 14, IL No. 6 (King River Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	8.77,9.54	400°F+ distillate, Ft. Lewis pilot plant, Chevron Sample No. WOW-3751	86

(Continued)

Table 340 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	7.70	One tpd pilot plant, heavy distillate[‡]	89
		Wyodak	9.14	One tpd pilot plant, heavy distillate[§]	101
		IL No. 6	8.66	One tpd pilot plant, heavy distillate, as received[‡]	123
		IL No. 6	8.97	One tpd pilot plant, rerun heavy distillate[‡]	123
		IL No. 6	8.26	One tpd pilot plant, heavy distillate[#]	99
		IL No. 6	8.26	One tpd pilot plant, heavy distillate[#]	99
		IL No. 6	8.05	One tpd pilot plant, heavy distillate[‡]	99
		IL No. 6	8.73	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-1[#]	99
		IL No. 6	8.87	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-2[#]	99
		IL No. 6	8.99	One tpd pilot plant, heavy distillate, UOP Sample No. 3532-3[#]	99
		IL No. 6	8.70	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99
		IL No. 6	8.01	One tpd pilot plant, 350°F^{+} distillate blend from "typical" run	99

(Continued)

Table 340 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	Wyodak	8.23	One tpd pilot plant, heavy distillate§	99
		Wyodak	7.33	One tpd pilot plant, heavy distillate**	99
		Wyodak	7.05	One tpd pilot plant, heavy distillate**	99
		Wyodak	8.13	One tpd pilot plant, 350 to 1000°F distillate blend from "typical" run	99
		Wyodak	7.05	One tpd pilot plant, 350°F+ distillate from "typical" run	99
		IL No. 6	4.32	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
		IL No. 6 (Monterey Mine)	4.54±0.20	One tpd pilot plant, vacuum bottoms, average of three operating conditions (840°F reactor temperature; 15-40 minutes residence time)	99
		IL No. 6 (Monterey Mine)	4.32±0.12	One tpd pilot plant, vacuum bottoms; operating conditions: 840°F reactor temperature; 15-40 minutes residence time, average of ten yield periods	99
		IL No. 6 (Monterey Mine)	4.52±0.24	75 lb per day development unit, vacuum bottoms; average of six operating conditions (800-880°F reactor temperature; 25-100 minutes residence time)	99
		IL No. 6 (Monterey Mine)	4.45±0.13	75 lb per day development unit, vacuum bottoms; operating conditions: 840°F reactor temperature; 40 minutes residence time, average of 21 yield periods	99

(Continued)

Table 340 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	EDS	Wyodak	4.15	One tpd pilot plant, vacuum bottoms from "typical" run (Run A-1)	99
		Wyodak	4.41±0.24	One tpd pilot plant, vacuum bottoms, average of six operating conditions (800-840°F reactor temperature; 40-100 minutes residence time)	99
		Wyodak	4.15±0.13	One tpd pilot plant, vacuum bottoms; operating conditions: 840°F reactor temperature; 60 minutes residence time, average of seven yield periods	99
		Wyodak	4.73±0.57	75 lb per day development unit, vacuum bottoms, average of eight operating conditions (800-880°F reactor temperature, 25-100 minutes residence time)	99
		Wyodak	4.29±0.07	75 lb per day development unit, vacuum bottoms; operating conditions: 880°F reactor temperature, 25 minutes residence time, average of six yield periods	99
		NA	12.04	One tpd pilot plant, vacuum bottoms (DuPont "Notebook" Sample No. 16928)	91
	H-Coal	NA	9.14	400-900°F heavy distillate from PDU	101
		IL No. 6	8.0	Heavy distillate from PDU, syncrude mode	109
		Wyodak	9.0	Heavy distillate from PDU, syncrude mode	109
		W.KY No. 11	7.4	Heavy distillate from PDU, syncrude mode	109

(Continued)

Table 340 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	H-Coal	IL No. 6	9.48	PDU, heavy distillate	153
		Wyodak	10.54	PDU, heavy distillate	153
		IL No.. 6	7.6	650-975°F heavy distillate from PDU, syncrude mode	98
		IL No. 6	7.13	650-975°F heavy distillate from PDU Run 5, Run 130-82, Period 29[††]	111
		Wyodak	8.01	650-975°F heavy distillate from PDU Run 6, Run 130-83, Period 17[‡‡]	112
		IL No. 6	5.47	975°F$^+$ residue from PDU Run 5, Run 130-82, Period 29[††]	111
		Wyodak	5.56	975°F$^+$ residue from PDU Run 6, Run 130-83, Period 17[‡‡]	112
		NA	8.33	400°F$^+$ fuel oil product from PDU; operating conditions: 851°F, 2500 psig	154
		NA	9.14	400°F$^+$ fuel oil product from PDU, rerun	123
Coal raw heavy distillate blends (heavy fuel oils)	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	8.04	0.4/1 middle/heavy distillate blend, Ft. Lewis pilot plant	101
		NA	7.9	Ft. Lewis pilot plant, 1/2 middle/heavy distillate blend	126
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	6.55	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116

(Continued)

Table 340 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	5.72	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116
		KY No. 9	6.71	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1983CB)	117
		KY No. 9	6.62	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1991CB)	117
		IL No. 6	8.60	Hydrotreated 400°F^{+} distillate from one tpd pilot plant[†]	89
	EDS	IL No. 6	10.85	From first stage hydrocracking of UOP raw 400°F^{+} heavy distillate Sample No. 3532-3[#] (UOP Sample No. 3532-9)	99
		IL No. 6	11.85	From first stage hydrocracking of UOP raw 400°F^{+} heavy distillate Sample No. 3532-2[#] (UOP Sample No. 3532-4)	99
		IL No. 6	13.39	From second stage hydrocracking of UOP hydrocracked Sample No. 3532-4	99
		IL No. 6	13.34	From second stage hydrocracking of UOP hydrocracked Sample No. 3532-4 (UOP Sample No. 3532-18)	99

(Continued)

Table 340 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydro treated heavy distillates (heavy) fuel oils) and residua	H-Coal	IL No. 6	9.17	PDU, fuel oil mode, from low severity hydrotreatment of 375-100°F distillate (DOE Sample No. 1617)	151
		IL No. 6	9.22	PDU, fuel oil mode, from medium severity hydrotreatment of 375-100°F distillate (DOE Sample No. 1618)	151
		IL No. 6	9.67	PDU, fuel oil mode, from high severity hydrotreatment of 375-100°F distillate (DOE Sample No. 1619)	151

Explanatory Notes

*The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillate from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined using solid fuel ASTM procedures.

‡A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F$^+$.

§A full range (350 to 1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw process solvent.

#A blend of raw naphtha, vacuum gas oil, and raw process solvent having a nominal boiling point of 400-1000°F.

**A blend of raw naphtha, vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 350°F$^+$.

††See Part IX, General Comments section, Note 4, for summary of operating conditions used.

‡‡See Part IX, General Comments section, Note 5, for summary of operating conditions used.

Table 341A. Trace Elements Content (Qualitative Data)

Material	Process	Coal Type	Trace Metals Present		Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I*	KY No. 9	Major	Fe,Si	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1897CB)*	82
			Minor	Al,Ti,Ca,		
			Trace	K,Cu,Zn Cr,Mn,Ni Cu,As,Pb,Zr		
		KY No. 9	Major	Al,Si,K,Ti	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)*	82
			Minor	Ca,Cr,Cu, Zn,Ce		
			Trace	Ni,Ca,As,Pb, Rb,St,Zr,Sr		
		KY No. 9	Major	Si,Fe	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1942CB-1)	82
			Minor	Ca,Ti,K, Zn,Mn,Ni, Cr,Zr		
		KY No. 9	Major	Si,Ca,Fe	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1949CB)*	82
			Minor	K,Ti,Zn,		
			Trace	Cr,Mn,Ni,Cu		
		KY No. 9	Major	Al,Si,K, Ca,Ti,Fe	Wilsonville pilot plant, heavy SRC unit (Run No. 225, APCI Sample No. 1914CB)	116
			Minor	Zn		
			Trace	Cr,Mn,Ni, Ce		
		KY No. 9	Major	Al,Ca,Ti,Fe	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
			Minor	Si,K,Zn		
			Trace	Cr,Mn,Ni,Ga, As,Pb		
		KY No. 9	Major	Al,Si,K,Ca, Ti,Fe,Zn	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
			Minor	Zn,Ga,Si,		
			Trace	Cr,Mn,Ni		
Hydro-treatd distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	Major	Fe,Si,Ti, Al,Ca	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC finer-29, APCI Sample No. 1943CB)	116
			Minor	K,V,Cr,Mn, Ni,Cu,Zn,Zr		
			Major	Ga,Ge,As, Pb,Mo		

(Continued)

Table 341A (Concluded)

Material	Process	Coal Type	Trace Metals Present		Sample Description/Source	Reference
Hydrotreated distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	Major Minor Trace	Fe,Sc,Ti, Al, Ca K,V,Cr,MN, Ni,Cu,Zn,Mo Cu,Ga,Ge,Pb, Rb,Y,Nb	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1951CB)	116
		KY No. 9	Major Minor Trace	Ni,Fe,Ti,Si, Al, Ca V,Cr,MN,Zn Sr,Zr,Mo	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1983CB)	117
		KY No. 9	Major Minor Trace	S,Fe,Ti,Si, Al, Ca V,Cr,Mn,Na, Mg P,Ce,Ni,Cu, Zn,Sr,Zr,Ga, Ge,As,Pb	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1991CB)	117

Table 341B. Trace Elements Content (Quantitative Data) (ppmw)

Material	Process	Coal Type	Ti	Na	K	Ca	V	Pb	Fe	P	Cd	Cr	Mn	Mg	Ni	Zn	Cu	Si	Sn	B
Coal raw heavy distillates and heavy fuel oils) and residua	SRC-I	KY No. 9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.17†
		KY No. 9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.17†
		KY No. 9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.25†
		NA	NA NA	8.8 NA	NA NA	NA 0.4	NA NA	NA <1	270 300	NA NA	NA NA	7.5 6.0	NA NA	NA NA	<6 2.1	8.1 7.2	NA 0.6	NA NA	NA NA	NA NA
	SRC-II	NA	7.1	31.0	63.0	25.0	2.3	0.54	155	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	2.7	14.0	7.2	9.1	0.23	0.1	85.0	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		NA	0.35	1.1	0.9	2.1	0.07	<0.16	51	<0.8	<0.05	11	0.86	0.35	4.1	0.1	0.17	3.7	<0.06	0.34
	H-Coal	IL No. 6	ND(2)	9	3	11	0.2	0.2	115	NA	NA	NA	NA	3	0.3	NA	NA	50	NA	NA
		Wyodak	18.6	26	5.0	5.07	1.3	0.5	175	NA	NA	NA	NA	106	0.7	NA	NA	66	NA	NA
		W. KY 11	1.0	1.6	1.6	2.5	ND (0.02)	0.2	550	NA	NA	NA	NA	0.6	0.6	NA	NA	297	NA	NA
		IL No. 6 (Burning Star Mine)	NA	NA	NA	NA	0.2	NA	1.0	NA	NA	NA	NA	NA	0.2	NA	NA	NA	NA	NA
Coal raw heavy distillate blends (heavy fuel oils) and residua		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hydro-treated heavy distillates (heavy fuel oils) and residua		NA	(SEE TABLE 341A)																	

(Continued)

Table 341B (Continued)

Mo	Ag	Co	Al	As	Hg	Sb	Ba	Be	Bi	Se	Sr	W	U	Sc	La	Ce	Pr	Nd	Sm	Eu	Gd
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	0.26	NA	2.1	0.02	0.066	0.14	NA	NA	0.17	0.96	NA	0.54	0.45	0.10	0.4	0.045	0.27	0.11	0.025	0.14
NA	NA	NA	NA	1.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
0.77	<0.06	<0.04	7.7	0.006§	ND	<0.3	0.04	<0.006	<1.0	0.003	0.05	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA
ND (0.8)	NA	ND (0.8)	4.9	0.04	ND (0.03)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ND (5)	NA	20	327	0.047	ND (0.07)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ND (0.02)	NA	0.1	6.3	0.19	ND (0.04)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

(Continued)

Table 341B (Concluded)

Tb	Ho	Er	Tm	Yb	Lu	Hf	Ta	Th	Rb	Cs	Br	Sample Description/Source	Reference
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
0.026 NA	0.030 NA	0.065 NA	0.016 NA	0.094 1.8	0.014 NA	0.054 NA	0.043 NA	0.19 NA	NA <0.4	0.012 NA	4.7 4.8	Ft. Lewis pilot plant, heavy SRC‡	146
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Ft. Lewis pilot plant	84
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Ft. Lewis pilot plant	84
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Ft. Lewis pilot plant	125
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	PDU, syncrude mode	109
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	PDU, syncrude mode	109
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	PDU, syncrude mode	96
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Heavy distillate from PDU (Ashland Oil Sample)	96
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--

Explanatory Notes

*The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillate from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Determined by flameless AAS. All other elements were determined by ICP.

‡Determined by neutron activation analysis and X-ray fluorescence.

§ACPI method.

Table 342. Ash Content (by Ultimate Analysis)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	0.10	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
		KY No. 9	0.05	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
		KY No. 9	0.05	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
		NA	0.09	Wilsonville pilot plant, heavy SRC	119
		NA	0.12	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run No. 6, Drum No. 120, Babcock & Wilcox Sample No. C-13994)	120
		NA	0.08	Wilsonville pilot plant, heavy SRC (Catalytic Inc. Sample No. SN-2651, Run No. 7D, Drum No. 97, Babcock & Wilcox Sample No. C-13995)	120
	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	0.058	Ft. Lewis pilot plant, heavy distillate	101
		NA	0.14	Ft. Lewis pilot plant, heavy distillate	84
		NA	0.03	Ft. Lewis pilot plant, heavy distillate	84
		KY No. 9 and 14 (King River Mine) and Pitt-Seam WV (Black-ville No. 2 Mine)	0.010	400°F+ distillate, Ft. Lewis pilot plant, Chevron Sample No. WOW-3751	86

(Continued)

Table 342 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	NA	0.6	Ft. Lewis pilot plant	126
	EDS	Wyodak	0.008	One tpd pilot plant, heavy distillate[*]	101
		IL No. 6	0.027	One tpd pilot plant, heavy distillate[†]	99
		IL No. 6	0.30	One tpd pilot plant, heavy distillate[‡]	99
		Wyodak	0.01	One tpd pilot plant, heavy distillate[*]	99
		Wyodak	0.07	One tpd pilot plant, heavy distillate[§]	99
		IL No. 6	17.7	One tpd pilot plant, residuum (flexicoker vacuum bottoms)	124
	H-Coal	NA	0.017	400-900°F heavy distillate from PDU	101
		IL No. 6	0.12	Heavy distillate from, PDU, syncrude mode	109
		Wyodak	0.06	Heavy distillate from PDU, syncrude mode	109
		W. KY No. 11	0.16	Heavy distillate from PDU, syncrude mode	109
		IL No. 6	0.13	Heavy distillate from PDU Run 8, syncrude mode	109
Coal raw heavy distillate blends (heavy fuel oils)	SRC-II	Pittsburgh No. 8 (Powhattan Mine)	0.031	0.4/1 middle/heavy distillate blend, Ft. Lewis pilot plant	
		NA	0.3	Ft. Lewis pilot plant, 1/2 middle/heavy distillate blend	126

(Continued)

Table 342 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	0.09	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116
		KY No. 9	0.08	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Lc-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116
		KY No. 9	0.29	Wilsonville pilot plant two-stage liquefaction (TSL) SRC from low conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1983CB)	117
		KY No. 9	0.17	Wilsonville pilot plant two-stage liquefaction (TSL) SRC from low conversion operation of SRC hydrocracker (H-Oil) unit (Wilsonville Run No. 235, APCI Sample No. 1991CB)	117

Explanatory Notes

*A full range (350 to 1000°F) distillate consisting of a blend of raw naphtha, vacuum gas oil and raw process solvent.

†A blend of raw naphtha, vacuum gas oil and raw process solvent having a nominal boiling point of 400-1000°F.

‡A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F$^+$.

§A blend of raw naphtha, vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 350°F$^+$.

Table 343. Saturates, Olefins and Aromatics Content

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
A. Saturates					
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	9.49	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)*	82
		KY No. 9	2.06	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)*	82
		KY No. 9	47.34	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC-Finer-29, APCI Sample No. 1942CB-1)*	82
		KY No. 9	16.90	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)	82
	H-Coal	IL No. 6	7.9	PDU, heavy distillate†	153
		Wyodak	12.6	PDU, heavy distillate†	153
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydro-treated heavy distillates (heavy fuel oils) and residua		IL No. 6	28.8§ (vol %)	From first stage hydro-cracking of UOP raw 400°F+ heavy distillate Sample No. 3532-3# (UOP Sample No. 3532-9)	99
		IL No. 6	54.8§ (vol %)	From first stage hydro-cracking of UOP raw 400°F+ heavy distillate Sample No. 3532-2# (UOP Sample No. 3532-4)	99

(Continued)

Table 343 (Continued)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
B. Aromatics					
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	40.54**	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)*	82
		KY No. 9	47.40**	Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)*	82
		KY No. 9	42.07**	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC-Finer-29, APCI Sample No. 1942CB-1)*	82
		KY No. 9	69.60**	Wilsonville pilot plant, heavy distillate from Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)*	82
		IL No. 6	86[§] (vol %)	One tpd pilot plant, heavy distillate; as received[††]	123
	H-Coal	IL No. 6	76.8	PDU, heavy distillate[†]	153
		Wyodak	74.2	PDU, heavy distillate[†]	153
		NA	91	400°F$^+$ fuel oil product from PDU, as received	123
		NA	90	400°F$^+$ fuel oil product from PDU, rerun	123
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--

(Continued)

Table 343 (Concluded)

Material	Process	Coal Type	Value (wt %)	Sample Description/Source	Reference
B. Aromatics (Continued)					
Hydrotreated heavy distillates (heavy fuel oils) and		IL No. 6	71.2 (vol %)	From first stage hydrocracking of UOP raw 400°F+ heavy distillate Sample No. 3532-3# (UOP Sample No. 3532-9)	99
residua		IL No. 6	45.2 (vol %)	From first stage hydrocracking of UOP raw 400°F+ heavy distillate Sample No. 3532-2# (UOP Sample No. 3532-4)	99

Explanatory Notes:

*The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillate from the SRC, LC-Finer and coker units, respectively (Reference 100).

†Additional data, nonhydrocarbons 15.3 wt %.

‡Additional data, nonhydrocarbons 13.2 wt %.

§Flame ionization analysis.

#A blend of raw naphtha, vacuum gas oil, and raw process solvent having a nominal boiling point of 400-1000°F.

**Determined via APCI adsorption chromatography method.

††A blend of vacuum gas oil, raw process solvent and coker liquid having a nominal boiling point of 400°F+.

Table 344. Detailed Hydrocarbon Class/Compound Analysis

Material	Process	Coal Type	Compound Class	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	9H-carbazole*,†		Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 220, APCI Sample No. 1898CB)‡	82
			A Methylphenanthrene			

			An Ethylphenanthrene			
			" " "			
			Pyrene			
			1-Phenylnaphthalene			
			A Methylpyrene			
			" " "			
			Docosane			
			Tricosane			
			Tetracosane			
			Pentacosane			
			Hexacosane			
			Heptacosane			
			Nonacosane			
			Triacontane			
			Hentriacontane			
			Dotriacontane			
			Tritriacontane			

(Continued)

Table 344 (Continued)

Material	Process	Coal Type	Compound Class	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	Phenanthrene*,† 9H-Carbazole A methylphenanthrene 4H-Cyclopenta(def) Phenanthrene 2-Phenyl-Naphthalene An-Ethyl-Phenanthrene A Dimethyl-Phenanthrene Fluoranthene Acephenanthrylene Pyrene 1-Phenyl-Naphthalene 1-Methyl-Pyrene Docosane A Terphenyl Tricosane Benzo(b)Naphtho-(2,1-d)Thiophene Chrysene Tetracosane Pentacosane to Tetratriacontane		Wilsonville pilot plant, heavy distillate from SRC unit (Run No. 225, APCI Sample No. 1912CB)‡	82

(Continued)

Table 344 (Continued)

Material	Process	Coal Type	Compound Class	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	NA	-Octane	ND	Ft. Lewis pilot plant, heavy SRC	146
			-Nonane	ND		
			-Decane	ND		
			-Undecane	0.0004		
			-Dodecane	0.0010		
			-Tridecane	0.0008		
			-Tetradecane	0.0007		
			-Pentadecane	0.0012		
			-Hexadecane	0.0008		
			-Heptadecane	0.0003		
			-Octadecane	0.0003		
			-Nonadecane	0.0022		
			-Eicosane	ND		
			-Heneicosane	ND		
			-Docosane	ND		
			-Tricosane	ND		
			-Tetracosane	ND		
			-Pentacosane	ND		
			-Hexacosane	0.0005		
			-Heptacosane	0.0002		
			-Octacosane	0.0002		
			-Nonacosane	0.0001		
			-Triacontane	0.0001		
			-Hentriacontane	0.0001		
			-Dotriacontane	ND		
			-Tritriacontane	ND		

(Continued)

Table 344 (Continued)

Material	Process	Coal Type	Compound Class	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	H-Coal	IL No. 6	X Class[§]		Heavy distillate from PDU, syncrude mode	109
			Monoaromatics			
			- 6 Alkyl Benzenes	0.1		
			- 8 Naphthene Benzenes	8.6		
			-10 Di-Naphthene Benzenes	6.5		
			Diaromatics			
			-12 Naphthalenes	7.9		
			-14 Acenaphthenes, Biphenyls	12.6		
			-16 Fluorenes	16.3		
			Triaromatics			
			-18 Phenanthrenes	9.8		
			-20 Naphthene Phenanthrenes	2.5		
			Tetraaromatics			
			-22 Pyrenes, Fluoranthrenes	3.7		
			-24 Chrysenes	0.1		
			Pentaaromatics			
			-26 Benzofluoranthrenes	0.2		
			-28 Perylenes	0.2		
			-30 Dibenzanthracenes	0.1		

(Continued)

Table 344 (Continued)

Material	Process	Coal Type	Compound Class	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	H-Coal	IL No. 6	X Class[§]		Heavy distillate from PDU, syncrude mode	109
			Monoaromatics			
			- 6 Alkyl Benzenes	0.5		
			- 8 Naphthene Benzenes	3.9		
			-10 Di-Naphthene Benzenes	4.0		
			Diaromatics			
			-12 Naphthalenes	2.4		
			-14 Acenaphthenes, Biphenyls	6.4		
			-16 Fluorenes	9.8		
			Triaromatics			
			-18 Phenanthrenes	7.8		
			-20 Naphthene Phenanthrenes	3.9		
			Tetraaromatics			
			-22 Pyrenes, Fluoranthrenes	6.1		
			-24 Chrysenes	1.6		
			Pentaaromatics			
			-26 Benzofluoranthrenes	1.4		
			-28 Perylenes	0.5		
			-30 Dibenzanthracenes	0.0		

(Continued)

Table 344 (Continued)

Material	Process	Coal Type	Compound Class	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	H-Coal	IL No. 6	X Class§		Heavy distillate from PDU, syncrude mode	109
			Monoaromatics			
			- 6 Alkyl Benzenes	0.0		
			- 8 Naphthene Benzenes	2.7		
			-10 Di-Naphthene Benzenes	2.0		
			Diaromatics			
			-12 Naphthalenes	0.3		
			-14 Acenaphthenes, Biphenyls	5.3		
			-16 Fluorenes	9.3		
			Triaromatics			
			-18 Phenanthrenes	9.3		
			-20 Naphthene Phenanthrenes	6.9		
			Tetraaromatics			
			-22 Pyrenes, Fluoranthrenes	13.2		
			-24 Chrysenes	3.6		
			Pentaaromatics			
			-26 Benzofluoranthrenes	2.2		
			-28 Perylenes	0.3		
			-30 Dibenzanthracenes	0.0		

(Continued)

Table 344 (Concluded)

Material	Process	Coal Type	Compound Class	Value (wt %)	Sample Description/Source	Reference
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--	--
Hydro-treated heavy distillates (heavy fuel oils) and residua	NA	--	--	--	--	--

Explanatory Notes

*The following compound types were present. Quantitative data not available.

†Compounds listed are the twenty most prevalent compounds present in the sample.

‡The raw heavy distillate from the proposed SRC-I pilot plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillate from the SRC, LC-Finer and coker units, respectively (Reference 100).

§X - from the molecular formula: $C_nH_{2n} + x$.

Table 345. Additional Detailed Individual Hydrocarbon Compound Analysis

Material	Process	Coal Type	Mass Spec. Peak Number	Molecular Weight	Formula	Concentration (parts per thousand)	Possible Compound Types	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	NA	1	128	$C_{10}H_8$	NA	Naphthalene	Wilsonville pilot plant, heavy SRC	147
			2	142	$C_{11}H_{10}$	NA	2-Methylnaphthalene		
			3	142	$C_{11}H_{10}$	NA	1-Methylnaphthalene		
			4	154	$C_{12}H_{10}$	0.10	Biphenyl		
			5	156	$C_{12}H_{12}$	NA	2-Ethylnaphthalene		
			6	156	$C_{12}H_{12}$	NA	2,6-Dimethylnaphthalene		
				170	$C_{13}H_{14}$	NA	and propylnaphthalene		
			7	154	$C_{12}H_{10}$	NA	Acenaphthene		
			9	166	$C_{13}H_{10}$	0.56	Fluorene		
			10	168	$C_{13}H_{12}$	0.16	Allylnaphthalene*		
			11	168	$C_{13}H_{12}$	0.10	Allylnaphthalene*		
			12	180	$C_{14}H_{12}$	0.27	9-Methylfluorene		
			16	182	$C_{14}H_{14}$	0.09	1,1-Diphenylethane		
			17	182		0.15	2,2'-Dimethylbiphenyl, 2,3'-Dimethylbiphenyl, 2,4'-Dimethylbiphenyl, 2-Methyldiphenylmethane, or 4-Methyldiphenylmethane		
			18	180	$C_{14}H_{12}$	0.34	9,10-Dihydroanthracene		
			19	180	$C_{14}H_{12}$	0.30	2-Methylfluorene		
			20	180	$C_{14}H_{12}$	0.63	1-Methylfluorene		
			21	182	$C_{14}H_{14}$	0.31	3,4'-Dimethylbiphenyl		
			24	182	$C_{14}H_{14}$	0.73	Ethylbiphenyl†		
			25	178	$C_{14}H_{10}$	27.00	Phenanthrene		
			26	194	$C_{15}H_{14}$	0.47	Ethylfluorene†		
			27	194	$C_{15}H_{14}$	0.18	Ethylfluorene†		
			30	194	$C_{15}H_{14}$	0.25	Ethylfluorene†		
			32	204	$C_{16}H_{12}$	0.30	1-Phenylnaphthalene		
			34	194	$C_{15}H_{12}$	4.30	3-Methylphenanthrene		
			35	192	$C_{15}H_{12}$	6.40	2-Methylphenanthrene		

(Continued)

Table 345 (Continued)

Material	Process	Coal Type	Mass Spec. Peak Number	Molecular Weight	Formula	Concentration (parts per thousand)	Possible Compound Types	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	NA	36	190	$C_{15}H_{10}$	0.69	4H-Cyclopenta(def) phenanthrene	Wilsonville pilot plant, heavy SRC	147
			37	192	$C_{15}H_{12}$	1.55	9-Methylphenanthrene		
			38	192	$C_{15}H_{12}$	1.79	1-Methylphenanthrene		
			45	206	$C_{16}H_{14}$	0.99	9-Ethylphenanthrene		
			46	206	$C_{16}H_{14}$	0.64	2-Ethylphenanthrene		
			47	206	$C_{16}H_{14}$	0.89	3,6-Dimethylphenanthrene		
			48	206	$C_{16}H_{14}$	0.80	2,7-Dimethylphenanthrene		
			49	206	$C_{16}H_{14}$	0.65	Ethylanthracene[†] or ethylphenanthrene[†]		
			50	206	$C_{16}H_{14}$	0.96	Ethylanthracene[†] or ethylphenanthrene[†]		
			51	202	$C_{16}H_{10}$	17.20	Fluoranthene		
			53	208	$C_{16}H_{16}$	0.99	2-Phenyl-1,2,3,4-tetrahydronaphthalene		
			54	202	$C_{16}H_{16}$	32.00	Pyrene		
			55	204	$C_{16}H_{12}$	3.60	Dibenzoheptafulvene		
			56	220	$C_{17}H_{16}$	0.60	Propylphenanthrene[†] or propylanthracene[†]		
			57	218	$C_{17}H_{14}$	0.26	Ethyl-$C_{16}H_{12}$[†,§]		
			58	218	$C_{17}H_{14}$	0.02	Ethyl-$C_{16}H_{12}$[†,§]		
			59	218	$C_{17}H_{14}$	0.51	Ethyl-$C_{16}H_{12}$[†,§]		
			60	220	$C_{17}H_{16}$	0.23	9-Methyl-10-ethylphenanthrene		

(Continued)

Table 345 (Continued)

Material	Process	Coal Type	Mass Spec. Peak Number	Molecular Weight	Formula	Concentration (parts per thousand)	Possible Compound Types	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	NA	61	218	$C_{17}H_{14}$	NA	Ethyl-$C_{16}H_{12}$†,§	Wilsonville pilot plant, heavy SRC	147
			62	218	$C_{17}H_{14}$	0.52	Ethyl-$C_{16}H_{12}$†,§		
			63	216	$C_{17}H_{12}$	2.88	Benzo(a)fluorene		
			64	220	$C_{17}H_{16}$	0.32	Propylphenanthrene† or propylanthracene†		
			65	216	$C_{17}H_{12}$	4.20	Benzo(b)fluorene		
			66	216	$C_{17}H_{12}$	2.98	Benzofluorene		
			67	216	$C_{17}H_{12}$	8.10	4-Methylpyrene		
			68	228	$C_{17}H_{14}$	3.40	Propylphenanthrene† or propylanthracene†		
			69	216	$C_{17}H_{12}$	4.30	2-Methylpyrene		
			70	216	$C_{17}H_{12}$	2.72	1-Methylpyrene		
			71	232	$C_{17}H_{16}$	0.86	Propyl-$C_{15}H_{12}$†§		
			72	232	$C_{18}H_{16}$	0.67	Propyl-$C_{15}H_{12}$†§		
			73	232	$C_{18}H_{16}$	0.61	Propyl-$C_{15}H_{12}$†§		
			74	230	$C_{18}H_{14}$	0.17	5,12-Dihydronaphthacene		
			75	230	$C_{18}H_{14}$	0.24	Ethylpyrene† or ethylfluoranthene†		
			76	230	$C_{18}H_{14}$	2.61	Ethylpyrene† or ethylfluoranthene†		
			77	230	$C_{18}H_{14}$	1.09	1-Ethylpyrene		
			78	230	$C_{18}H_{14}$	2.62	Ethylpyrene† or ethylfluoranthene†		
			79	230	$C_{18}H_{14}$	0.66	Ethylpyrene† or ethylfluoranthene†		
			82	232	$C_{17}H_{16}$	1.10	Propyl-$C_{16}H_{12}$†,§		
			84	232	$C_{18}H_{16}$	0.31	Propyl-$C_{16}H_{12}$ †,§		
			85	228	$C_{18}H_{12}$	2.43	Benz(a)anthracene		
			86	228	$C_{18}H_{12}$	9.60	Triphenylene and chrysene		
			88	242	$C_{19}H_{14}$	0.24	Propylpyrene† or propylfluoranthene†		
			89	242	$C_{19}H_{14}$	1.87	2-Methyltriphenylene		

(Continued)

Table 345 (Continued)

Material	Process	Coal Type	Mass Spec. Peak Number	Molecular Weight	Formula	Concentration (parts per thousand)	Possible Compound Types	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	NA	90	258	$C_{20}H_{18}$	0.56	NA	Wilsonville pilot plant, heavy SRC	147
			92	242	$C_{19}H_{14}$	0.78	11-Methylbenz(a)anthracene		
			93	242	$C_{19}H_{14}$	0.43	2-Methylbenz(a)anthracene		
			94	242	$C_{18}H_{14}$	0.63	1-Methylbenz(a)anthracene		
			95	242	$C_{19}H_{14}$	3.10	1-Methyltriphenylene		
			96	242	$C_{19}H_{14}$	2.21	3-Methylchrysene		
			97	242	$C_{19}H_{14}$	1.91	12-Methylbenz(a)anthracene		
			98	242	$C_{19}H_{14}$	1.49	4-Methylbenz(a)anthracene or 5-methylchrysene		
			99	242	$C_{19}H_{14}$	0.67	6-Methylchrysene or 4-methylchrysene		
			100	254	$C_{20}H_{14}$	0.53	Phenylphenanthrene		
			101	256	$C_{20}H_{16}$	0.81	Ethyl-$C_{18}H_{12}{}^{\dagger\ddagger}$		
			102	254	$C_{20}H_{14}$		2,2'-Binaphthyl		
			103	254	$C_{20}H_{14}$	1.06	Phenylphenanthrene		
			104	256	$C_{20}H_{16}$	0.46	Ethyl-$C_{18}H_{12}{}^{\dagger\ddagger}$		
			105	256	$C_{20}H_{16}$	0.46	Ethyl-$C_{18}H_{12}{}^{\dagger\ddagger}$		
			106	256	$C_{20}H_{16}$	0.52	Ethyl-$C_{18}H_{12}{}^{\dagger\ddagger}$		
			107	256	$C_{20}H_{16}$	1.30	Ethyl-$C_{18}H_{12}{}^{\dagger\ddagger}$		
			108	256	$C_{20}H_{16}$	0.63	Ethyl-$C_{18}H_{12}{}^{\dagger\ddagger}$		
			109	256	$C_{20}H_{16}$	0.91	Ethyl-$C_{18}H_{12}{}^{\dagger\ddagger}$		
			110	256	$C_{20}H_{16}$	0.64	Ethyl-$C_{18}H_{12}{}^{\dagger\ddagger}$		
			111	252	$C_{20}H_{12}$	5.70	Benzo(j)fluoranthene		
			112	252	$C_{20}H_{12}$	0.75	Benzofluoranthene		
			113	268	$C_{21}H_{16}$	0.40	Methylbinaphthyl		
			114	252	$C_{20}H_{12}$	3.60	Benzo(e)pyrene		
			115	252	$C_{20}H_{12}$	3.40	Benzo(a)pyrene		
			116	252	$C_{20}H_{12}$	0.91	Perylene		
			117	266	$C_{21}H_{14}$	0.48	Methyl-$C_{20}H_{12}{}^{**}$		
			118	266+	$C_{21}H_{14}$	1.82	Methyl-$C_{20}H_{12}{}^{**}$		
				280	$C_{22}H_{16}$		Ethyl-$C_{20}H_{12}{}^{\dagger,**}$		
			119	266	$C_{21}H_{14}$	2.31	Methyl-$C_{20}H_{12}{}^{**}$		
			120	266	$C_{21}H_{14}$	1.96	Methyl-$C_{20}H_{12}{}^{**}$		
			121	266	$C_{21}H_{14}$	1.11	Methyl-$C_{20}H_{12}{}^{**}$		
			122	266	$C_{21}H_{14}$	1.77	Methyl-$C_{20}H_{12}{}^{**}$		
			123	266	$C_{21}H_{14}$		Methyl-$C_{20}H_{12}{}^{**}$		
			124	266	$C_{21}H_{14}$	2.47	Methyl-$C_{20}H_{12}{}^{**}$		

(Continued)

Table 345 (Continued)

Material	Process	Coal Type	Mass Spec. Peak Number	Molecular Weight	Formula	Concentration (parts per thousand)	Possible Compound Types	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residue	SRC-I	NA	125	268	$C_{21}H_{16}$	0.62	Methylcholanthrene	Wilsonville pilot plant, heavy SRC	147
			126	266	$C_{21}H_{14}$	0.60	Methyl-$C_{20}H_{12}$**		
			127	266	$C_{21}H_{14}$	0.54	Methyl-$C_{20}H_{12}$**		
			128	282	$C_{22}H_{18}$	0.44			
			129	280	$C_{22}H_{16}$	NA	Ethyl-$C_{20}H_{12}$†,**		
			130	280	$C_{22}H_{16}$	NA	Ethyl-$C_{20}H_{12}$†,**		
			131	280	$C_{22}H_{16}$	1.49	Ethyl-$C_{20}H_{12}$†,**		
			132	280	$C_{22}H_{16}$	0.67	Ethyl-$C_{20}H_{12}$†,**		
			133	280	$C_{22}H_{16}$	0.39	Ethyl-$C_{20}H_{12}$†**		
			134	280	$C_{22}H_{16}$	0.46	Ethyl-$C_{20}H_{12}$†**		
			136	280	$C_{22}H_{16}$	0.52	Ethyl-$C_{20}H_{12}$†**		
			136	268	$C_{22}H_{14}$	1.12	Dibenzanthracene		
			137	276	$C_{22}H_{12}$	0.40	††		
			138	278	$C_{22}H_{14}$	NA	Benzo(b)chrysene		
			139	278	$C_{22}H_{14}$	2.23	Picene		
			140	276	$C_{22}H_{12}$	0.67	††		
			141	276	$C_{22}H_{12}$	0.279	Methyl-$C_{22}H_{14}$††		
			142	292	$C_{23}H_{16}$	0.89	Methyl-$C_{22}H_{14}$††		
			143	292	$C_{23}H_{16}$	0.84	Methyl-$C_{22}H_{14}$††		
			144	292	$C_{23}H_{16}$	1.81	Methyl-$C_{22}H_{14}$††		
			145	292	$C_{23}H_{16}$	NA	Methyl-$C_{22}H_{14}$††		
			146	290	$C_{23}H_{14}$		Methyl-$C_{22}H_{12}$††		
	SRC-I	NA	1##	226	$-C_{16}$	NA	NA		
			2	240	$-C_{17}$	NA	NA		
			3	254	$-C_{18}$	NA	NA		
			4	268	$-C_{19}$	NA	NA		
			5	282	$-C_{20}$	NA	NA		
			6	296	$-C_{21}$	NA	NA		
			7	310	$-C_{22}$	NA	NA		
			8	324	$-C_{23}$	NA	NA		
			9	338	$-C_{24}$	NA	NA		
			10	352	$-C_{25}$	NA	NA		
			11	366	$-C_{26}$	NA	NA		
			12	380	$-C_{27}$	NA	NA		
			13	394	$-C_{28}$	NA	NA		
			14	408	$-C_{29}$	NA	NA		

(Continued)

Table 345 (Continued)

Material	Process	Coal Type	Mass Spec. Peak Number	Molecular Weight	Formula	Concentration (parts per thousand)	Possible Compound Types	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	NA	1***	142	NA	NA	C_1-naphthalene	Wilsonville pilot plant, heavy SRC	132
				156	NA	NA	C_2-naphthalene		
				170	NA	NA	C_3-naphthalene		
				154	NA	NA	biphenyl		
				154	NA	NA	acenophthene		
				168	NA	NA	dibenzofuran		
			2	166	NA	NA	fluorene		
			3	168	NA	NA	C_1-biphenyl/C_1-acenaphthene		
			4	168	NA	NA	C_1-biphenyl/C_1-acenaphthene		
			5	184/180	NA	NA	C_4-naphthalene/C_1-fluorene		
			6	182	NA	NA	C_1-dibenzofuran		
			7	182	NA	NA	C_2-biphenyl		
			8	180/182	NA	NA	C_1-fluorene/C_2-biphenyl		
			9	198/194	NA	NA	C_5-naphthalene/C_2-fluorene		
			10	184	NA	NA	dibenzothiophene		
			11	182	NA	NA	tetrahydrophenanthrene		
			12	196	NA	NA	C_3-biphenyl		
			13	178	NA	NA	phenanthrene		
			14	196	NA	NA	C_3-biphenyl/ C_1-dibenzothiophene		
			15	204	NA	NA	1-phenylnaphthalene		
			16	192	NA	NA	C_1-phenanthrene		
			17	204	NA	NA	2-phenylnaphthalene		
			18	206	NA	NA	C_2-phenanthrene		
			19	202	NA	NA	fluoranthene		
			20	202	NA	NA	pyrene		
			21		NA	NA	not identified		
			22	216	NA	NA	benzo[a]fluorene		
			23	216	NA	NA	benzo[b]fluorene		
			24	216	NA	NA	C_1-pyrene/ C_1-fluoranthene		
			25	230	NA	NA	C_2-pyrene/ C_2-fluoranthene		
			26	228	NA	NA	benz[a]anthracene		
			27	228	NA	NA	chrysene		

(Continued)

Table 345 (Continued)

Material	Process	Coal Type	Mass Spec. Peak Number	Molecular Weight	Formula	Concentration (parts per thousand)	Possible Compound Types	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	NA	28	242	NA	NA	C_1-benz[a]anthracene/ C_1-chrysene	Wilsonville pilot plant, heavy SRC	147
			29	252	NA	NA	benzofluoranthene		
			30	252	NA	NA	benzopyrene		

Process	Coal Type	Compound	Mol. wt Parent	Mol. wt Pentafluoropropyl Derivative	Sample Description/Source	Reference
SRC-II	NA	Aliphatic hydrocarbon fraction A-1			Ft. Lewis pilot plant, heavy distillate	132
		n-C_{16}	226	NA		
		n-C_{17}	240	NA		
		n-C_{18}	254	NA		
		n-C_{19}	268	NA		
		n-C_{20}	282	NA		
		n-C_{21}	296	NA		
		n-C_{22}	310	NA		
		n-C_{23}	324	NA		
		n-C_{24}	338	NA		
		n-C_{25}	352	NA		
		n-C_{26}	366	NA		
		n-C_{27}	380	NA		
		n-C_{28}	394	NA		
		n-C_{29}	408	NA		
		PAC fraction A-2				
		C_1-naphthalene	142	NA		
		C_2-naphthalene	156	NA		
		C_3-naphthalene	170	NA		
		biphenyl	154	NA		
		acenaphthene	154	NA		
		dibenzofuran	168	NA		
		fluorene	166	NA		
		C_1-biphenyl/C_1-acenaphthene	168	NA		
		C_1-biphenyl/C_1-acenaphthene	168	NA		
		C_4-naphthalene/C_1-fluorene	184/180	NA		
		C_1-dibenzofuran	182	NA		
		C_2-biphenyl	182	NA		
		C_1-fluorene/C_2-biphenyl	180/182	NA		
		C_5-haphthalene/C_2-fluorene	198/194	NA		
		dibenzothiophene	184	NA		
		tetrahydrophenanthrene	182	NA		
		C_3-biphenyl	196	NA		
		phenanthrene	178	NA		

(Continued)

Table 345 (Concluded)

Material	Process	Coal Type	Mass Spec Peak Number	Compound	Mol. wt Parent	Mol. wt Pentafluoropropyl Derivative	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	NA		PAC Fraction A-2			Ft. Lewis pilot plant, heavy distillate	132
				C_3-bephenyl/C_1-dibenzothiophene	196	NA		
				1-phenylnaphthalene	204	NA		
				C_1-phenanthrene	192	NA		
				2-phenylnaphthalene	204	NA		
				C_2-phenanthrene	206	NA		
				fluoranthene	202	NA		
				pyrene	202	NA		
				not identified				
				benzo[a]fluorene	216	NA		
				benzo[b]fluorene	216	NA		
				C_1-pyrene/C_1-fluoranthene	216	NA		
				C_2-pyrene/C_2-fluoranthene	230	NA		
				benz[a]anthracene	228	NA		
				chrysene	228	NA		
				C_1-benz[a]anthracene/C_1-chrysenes	242	NA		
				benzofluoranthene	252	NA		
				benzopyrene	252	NA		
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--	--	--	--
Hydro-treated heavy distillates (heavy fuel oils) and residua	NA	--	--	--	--	--	--	--

Explanatory Notes:

*Good visual fit was shown to standard spectrum of allylnaphthalene. However, methylacenaphthene cannot be ruled out in absence of standard spectrum

†May also be dimethyl

‡May also be trimethyl or ethylmethyl

§Possible isomers of $C_{16}H_{12}$ include the following: 4H-cyclopenta(def)-phenanthrene, benzacenaphthene, or phenyl naphthalene

‖Possible isomers of $C_{18}H_{12}$ include: chrysene, benz(a)anthracene, and triphenylene

**Possible isomers of $C_{20}H_{12}$ include: benzofluoranthene, benzo(e)pyrene, benzo(a)pyrene, and perylene

††Compounds with MW 276 could be isomers of the following: indenopyrene, indenofluoranthene, aceperylene, phenanthrofluorene, acenaphthacenaphylene, dibenzofluoranthene, benzoaceperylene, or acefluoranthylene

‡‡Possible isomers of $C_{22}H_{14}$ include: dibenzanthracene, benzo(b)chrysene, and picene

§§Determined via - alumina - silicic acid fractionation followed by GC-MS analysis

‖‖Aliphatic-hydrocarbon fraction

***Polycyclic aromatic compound fraction

Table 346. Additional Hydrocarbon Class Analysis Obtained by Solvent Fractionation*

Material	Process	Coal Type	Value	(wt %)	(mol wt)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	Oils	3.7	180	Wilsonville pilot plant, heavy SRC (Run No. 225, APCI Sample No. 1914CB)	116
			Asphaltenes	63.3	570		
			Preasphaltenes	33.0	1360		
			Residue	0.0	NA		
		KY No. 9	Oils	11.7	220	Wilsonville pilot plant, heavy SRC (Run No. 220, APCI Sample No. 1916CB)	116
			Asphaltenes	62.0	490		
			Preasphaltenes	26.3	1840		
			Residue	0.0	NA		
		KY No. 9	Oils	5.0	560	Wilsonville pilot plant, heavy SRC (Run No. 209, APCI Sample No. 1917CB)	116
			Asphaltenes	65.7	480		
			Preasphaltenes	27.3	NA		
			Residue	0.0	NA		
		Kentucky	Oils (propane solubles)	4-6	NA	Heavy SRC	98
	SRC-II	Kentucky	Oils (propane solubles)	99^+	NA	Ft. Lewis pilot plant, 482-860°F heavy distillates	98
		KY No. 9 and 14, IL No. 6 (King River Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	Hot heptane asphaltenes	0.2200	NA	400°F$^+$ distillate, Ft. Lewis pilot plant, Chevron Sample No. WOW-3751	86
			Benzene Insolubles	<0.03	NA		

(Continued)

Table 346 (Continued)

Material	Process	Coal Type	Value	(wt %)	(mol wt)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	H-Coal	IL No. 6	Asphaltenes Toluene Insolubles	36.40 0.29	NA NA	650-975°F heavy distillate from PDU Run 5, Run 130-82, Period 29[†]	111
		IL No. 6	Asphaltenes Toluene Insolubles[‡]	12.8 0.17	NA NA	650-975°F heavy distillate from PDU Run 6, Run 130-83, Period 17[§]	112
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--			--	--
Hydro-treated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	Oils Asphaltenes Preasphaltenes Residue	64.6 24.0 11.4 NA	NA[#] NA[#] NA[#] NA	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from low conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1943CB)	116

(Continued)

Table 346 (Concluded)

Material	Process	Coal Type	Value	(wt %)	(mol wt)	Sample Description/Source	Reference
Hydro-treated heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	Oils	60.3	NA	Wilsonville pilot plant, two-stage liquefaction (TSL) SRC from high conversion operation of Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1951CB)	116
			Asphaltenes	28.9	NA		
			Preasphaltenes	10.8	NA		
			Residue	NA	NA		

Explanatory Notes:

*Sample obtained via solvent fractionation methods are defined as follows: The asphaltene fraction is that portion of certain crude oil distillation fractions that is insoluble in n-pentane but soluble in benzene. The carbene fraction is that portion of the crude oil distillation fractions that is insoluble in benzene but soluble in carbon disulfide; the carboid fraction is that portion that is insoluble in both benzene and in carbon disulfide. Resins are polar materials in maltenes (that portion of the crude oil distillation fractions that is soluble in n-pentane) that are retained by adsorbents in a standard SARA technique recycle chromatographic column. Oils are resins-free maltenes (Reference 59, 82).

†See Part IX, General Comments section, Note 4, for summary of operating conditions used.

‡Precipitated in toluene prior to asphaltenes

§See Part IX, General Comments section, Note 5, for summary of operating conditions used.

#Not complete.

Table 347. Elemental Composition Data for Hydrocarbon Classes Obtained by Solvent Fractionation

Material	Process	Coal Type	Value	(wt %)	Sample Description/Source	Reference
Coal raw distillates (heavy fuel oils) and residua	H-Coal	IL No. 6	Oil		400°F$^+$ fuel oil product from PDU; operating conditions: 851°F, 2500 psig.	154
			carbon	89.54		
			hydrogen	9.18		
			nitrogen	0.45		
			sulfur	<0.05		
			oxygen	0.83*		
			Resin			
			carbon	89.39		
			hydrogen	7.07		
			nitrogen	1.13		
			sulfur	0.14		
			oxygen	2.27*		
			Asphaltene			
			carbon	86.88		
			hydrogen	5.91		
			nitrogen	1.61		
			sulfur	0.64		
			oxygen	4.96*		
			Carbene			
			carbon	87.18		
			hydrogen	5.05		
			nitrogen	1.93		
			sulfur	0.94		
			oxygen	4.90*		
			Carboid			
			carbon	86.09		
			hydrogen	4.87		
			nitrogen	1.51		
			sulfur	0.97		
			oxygen	6.56*		
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--	--

(Continued)

Table 347 (Concluded)

Material	Process	Coal Type	Value	(wt %)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residua	NA	--	--	--	--	--

Explanatory Note

*By difference

Table 348. Nitrogen-, Oxygen- and Sulfur-Containing Compounds*

Material	Process	Coal Type	Value Compound Class	Wt %	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	Phenols	44.77	Wilsonville pilot plant, SRC unit (Run No. 220, APCI Sample No. 1898CB)†	82
		KY No. 9	Phenols	40.56	Wilsonville pilot plant, SRC unit (Run No. 225, APCI Sample No. 1912CB)†	82
		KY No. 9	Phenols	3.40	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-29, APCI Sample No. 1942CB-1)†	82
		KY No. 9	Phenols	6.90	Wilsonville pilot plant, Lummus LC-Finer unit (Lummus Run No. 2-LC Finer-27, APCI Sample No. 1950CB)†	82

(Continued)

Table 348 (Continued)

Material	Process	Coal Type	Value		Sample Description/Source	Reference
			Compound Class	Wt %		
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	KY No. 9	Phenol	ND	Wilsonville pilot plant, heavy distillate from Alcoa coker unit (APCI Sample No. 1899CB). Caustic extraction with 20% NaOH, 1/1-v/v, GC analysis of extract	82
			o-Cresol	0.12		
			m+p-Cresol	1.52		
			2,6-Xylenol	0.09		
			o-Ethylphenol	0.21		
			2,4- and 2,8-Xylenol	0.98		
			m+p-Ethylphenol	1.79		
			2,3-Xylenol	0.17		
			3,4-Xylenol	0.31		
			Heavier phenolics	9.66		
			Total	14.85		
		NA	Sulfur Forms,		Wilsonville pilot plant, heavy SRC, C-E Sample No. 2440-C	82
			Pyritic	0.01		
			Organic	0.85		
			Sulfate	0.00		
		NA	Sulfur Forms,		Wilsonville pilot plant, heavy SRC, C-E Sample No. 2441-C	118
			Pyritic	0.00		
			Organic	0.79		
			Sulfate	0.00		
		Kentucky	Sulfur,		Heavy SRC	98
			-Organic	(0.7-0.8)		
			-Pyritic	Trace		
			-Sulfate	Nil		

(Continued)

Table 348 (Continued)

Material	Process	Coal Type	Peak No.	Retension Time (min)	Compound	Total Ion count (%)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residue	SRC-I	NA	1	9.6	2-methylpyridine	<0.5	Wilsonville pilot plant, heavy SRC	148
			2	9.7	2-methyl-5-propylpyridine	<0.5		
			3	10.0	2,3,5-trimethylpyridine	<0.5		
			4	10.9	N,N'-diethylaniline	<0.5		
			5	11.1	2,4-dimethyl-5-ethylpyridine	<0.5		
			6	11.5	2,6-dimethyl-4-ethylpyridine	<0.5		
			7	11.9	2,4,6-trimethylpyridine	<0.5		
			17	14.9	N,N'-dimethyl-4-ethylaniline	<0.5		
			27	17.3	1,2,3,4-tetrahydroquinoline	<0.5		
			28	17.9	2-methyl-1,2,3,4-tetrahydroquinoline	<0.5		
			32	19.1	1,2-dimethyl-2,3-dihydroindole	1.06		
			35	19.8	2-methyl-2,3-dihydroindole	0.50		
			36	20.0	3-methyl-2,3-dihydroindole	1.15		
			37	20.6	6-methyl-1,2,3,4-tetrahydroquinoline	0.54		
			38	20.9	aniline	1.50		
			42	22.2	4-methylaniline	0.65		
			44	23.1	3-methylaniline	0.62		
			45	23.4	5-amino-1,2,3,4-tetrahydronaphthalene	0.88		
			46	23.7	N-ethylaniline	0.63		
			47	24.0	3-methyl-1,2,3,4-tetrahydroquinoline	0.51		
			48	24.5	dimethylaniline (any isomer)	4.60		
			50	25.1	quinoline	4.0		
			52	26.0	2-methylquinoline	1.47		
			53	26.8	1-methylisoquinoline	0.89		
			55	27.5	2-ethylquinoline	2.70		
			58	28.3	methylquinoline (any isomer)	2.60		
			59	28.6	dimethylquinoline (any isomer)	<0.5		
			62	29.6	1-ethylisoquinoline	<0.5		
			63	29.7	7-ethylquinoline	1.60		
			64	29.8	4-isopropylquinoline	1.76		
			68	31.1	straight chain butylquinoline (any isomer)	1.06		
			70	32.1	dibenzofuran	0.90		
			73	33.0	8-propylquinoline	0.86		
			74	33.2	straight-chain butylquinoline (any isomer)	<0.5		
			75	33.3	methyl-ethylquinoline (any isomer)	<0.5		
			78	34.1	5-butylquinoline	0.89		
			80	35.0	butylquinoline (any isomer)	0.91		
			81	35.1	2,3,4-trimethylquinoline	<0.5		
			86	37.0	phenyl-p-tolylamine	1.32		
			88	37.1	N,N'-diphenyl-ethylamine	1.00		
			89	37.2	phenoxazine	<0.5		
			90	37.4	methyl-biphenylamine	<0.5		
			96	39.0	N,N'-diphenyl-methylamine	2.83		
			102	41.6	biphenylamine	1.34		
			112	43.0	a trimethyl benzoquinoline (isomer)			

(Continued)

Table 348 (Continued)

Material	Process	Coal Type	Peak No.	Retension Time (min)	Compound	Total Ion count (%)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	NA	115	43.8	benzol[f]quinoline	<0.5	Wilsonville pilot plant, heavy SRC	148
			118	45.0	a methyl benzoquinoline (isomer)	2.58		
			119	45.2	benzo[h]quinoline	1.73		
			120	45.7	phenanthridine	1.87		
			124	47.6	acridine	3.20		
			125	48.3	a methyl benzoquinoline (isomer)	2.20		
			126	48.9	methyl benzoquinoline (any isomer)	2.50		
			127	49.6	a methyl benzoquinoline isomer	1.24		
			128	50.0	a methyl benzoquinoline isomer	1.20		
			129	50.2	a methyl benzoquinoline isomer	1.28		
			134	52.6	a methyl benzoquinoline isomer	1.70		
			135	53.2	a methyl benzoquinoline isomer	0.85		
			150	60.0	an ethyl benzoquinoline isomer	<0.5		
			Compound Class			wt %		
	SRC-II	NA	Hydrocarbons, N-alkylated pyrrolic compounds			3.8	Ft. Lewis pilot plant, Run No. 77 SR-12	130
			Diarylamines, indoles, carbazoles			8.0		
			Mono- and diarylamines			2.8		
			Aniline types, hindered pyridines			12.5		
			Pyridine benzologs			72.2		
			Amines, amides, bifunctionals			4.0		
			Total			103.3		

(Continued)

Table 348 (Continued)

Material	Process	Coal Type	Compound Class	wt %	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	Kentucky	Sulfur,		Ft. Lewis pilot plant, 482-860°F heavy distillate	98
			- organic	(0.2-0.4)		
			- pyritic	NA		
		KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	Basic nitrogen	0.82	400°F^{+} distillate, Ft. Lewis pilot plant, Chevron Sample No. WOW-3751	86
	H-Coal	IL No. 6	X Class[†]		Heavy distillate from PDU syncrude mode	109
			Aromatic Sulfur Types			
			-10 Benzothiophenes	2.3[§]		
			-16 Dibenzothiophenes	0.0		
			-22 Naphthobenzothiophene	0.1		
			Unidentified	0.0		
		Wyodak	X Class[†]		Heavy distillate from PDU syncrude mode	109
			Aromatic Sulfur Types			
			-10 Benzothiophenes	1.9[§]		
			-16 Dibenzothiophenes	1.0		
			-22 Naphthobenzothiophene	0.2		
			Unidentified	0.0		

(Continued)

Table 348 (Concluded)

Material	Process	Coal Type	Compound Class	(wt %)	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	H-Coal	W. KY. 11	X Class§		Heavy distillate from PDU, syncrude mode	109
			Aromatic Sulfur Types			
			-10 Benzothiophenes	2.0§		
			-16 Dibenzothiophenes	1.2		
			-22 Naphthobenzothiophene	0.0		
			Unidentified	0.0		
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--	--
Hydro-treated distillates (heavy fuel oils) and residua	NA	--	--	--	--	--

Explanatory Notes

*All values by MS analysis.

†The raw middle distillate from the proposed SRC-I demonstration plant will consist of a 29.0/71.0/0.0 weight percent blend of heavy distillate from the SRC, LC-Finer and coker units, respectively (Reference 100).

‡From the molecular formula: C_nH_{2n+x}.

§Analysis by GC/MS.

Table 349. Detailed Individual Nitrogen- and Sulfur-Containing Compounds

Material	Process	Coal Type	Compound	Mol wt		Method of Identification†	Concn,‡ µg/g	Sample Description/ Source	Reference
				Parent	Pentafluoropropyl Derivative				
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	NA	aminoindan	131	277	GC/MS,LRMS		Ft. Lewis pilot plant, heavy distillate*	131
			C_1-aminoindan	145	291	LRMS			
			aminonaphthalene	143	289	GC/ECD,GC/MS,LRMS	204.3§		
			C_1-aminonaphthalene	157	303	GC/ECD,GC/MS,LRMS	100.6		
			C_2-aminonaphthalene	171	317	GC/ECD,GC/MS,LRMS	95.2		
			C_3-aminonaphthalene	185	331	LRMS			
			aminoquinoline	144	290	LRMS,HRMS			
			C_1-aminoquinoline	158	304	LRMS,HRMS			
			C_2-aminoquinoline	172	318	LRMS,HRMS			
			C_3-aminoquinoline	186	332	HRMS			
			C_4-aminoquinoline	200	346	HRMS			
			aminoacenaphthylene/ aminobiphenyl	169	315	GC/ECD,GC/MS,LRMS	237.3‖		
			C_1-aminoacenaphthylene/ aminobiphenyl	183	329	GC/ECD,GC/MS,LRMS	155.8		
			C_2-aminoacenaphthylene/ aminobiphenyl	197	343	GC/ECD,GC/MS,LRMS,HRMS	102.7		
			C_3-aminoacenaphthylene/ aminobiphenyl	211	357	LRMS			
			C_4-aminoacenaphthylene/ aminobiphenyl	225	371	LRMS			
			aminofluorene	181	327	GC/ECD,GC/MS,LRMS,HRMS	121.2		
			C_1-aminofluorene	195	341	GC/MS,LRMS,HRMS			
			C_2-aminofluorene	209	355	GC/MS,LRMS,HRMS			
			C_3-aminofluorene	223	369	LRMS			
			C_4-aminofluorene	237	383	LRMS			
			aminocarbazole	182	328	LRMS,HRMS			
			C_1-aminocarbazole	196	342	LRMS,HRMS			
			C_2-aminocarbazole	210	356	LRMS			
			C_3-aminocarbazole	224	370	LRMS			
			aminoanthracene/ aminophenanthrene	193	339	GC/ECD,GC/MS,LRMS	153.2**		
			C_1-aminoanthracene/ aminophenanthrene	207	353	GC/MS,LRMS,HRMS			
			C_2-aminoanthracene/ aminophenanthrene	221	367	GC/MS,LRMS,HRMS			

(Continued)

Table 349 (Continued)

Material	Process	Coal Type	Compound	Mol wt		Method of Identification[†]	Concn.,[†] g/g	Sample Description/ Source	Reference
				Parent	Pentafluoropropyl Derivative				
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	NA	C_3-aminoanthracene/ aminophenanthrene	235	381	LRMS,HRMS		Ft. Lewis pilot plant, heavy distillate*	131
			C_4-aminoanthracene/ aminophenanthrene	249	395	LRMS,HRMS			
			C_5-aminoanthracene/ aminophenanthrene	263	409	LRMS,HRMS			
			aminophenanthridine/ aminoacridine	194	340	LRMS			
			C_1-aminophenanthridine/ aminoacridine	210	354	LRMS,HRMS			
			C_2-aminophenanthridine/ aminoacridine	224	368	LRMS,HRMS			
			C_3-aminophenanthridine/ aminoacridine	238	382	LRMS,HRMS			
			aminophenylnaphthalene	219	365	GC/MS,LRMS			
			C_1-aminophenylnaphthalene	233	379	GC/MS,LRMS			
			C_2-aminophenylnaphthalene	247	393	GC/MS,LRMS			
			C_3-aminophenylnaphthalene	261	407	GC/MS,LRMS			
			C_4-aminophenylnaphthalene	275	421	LRMS			
			aminofluoranthene/ aminopyrene	217	363	GC/ECD,GC/MS,LRMS	49.0[††]		
			C_1-aminofluoranthene/ aminopyrene	231	377	GC/MS,LRMS,HRMS			
			C_2-aminofluoranthene/ aminopyrene	245	391	GC/MS,LRMS,HRMS			
			C_3-aminofluoranthene/ aminopyrene	259	405	LRMS,HRMS			
			C_4-aminofluoranthene/ aminopyrene	273	419	LRMS			
			aminochrysene/ aminobenzanthracene	243	389	GC/ECD,GC/MS,LRMS	18.7		
			C_1-aminochrysene/ aminobenzanthracene	257	403	LRMS,HRMS			
			C_2-aminochrysene/ aminobenzanthracene	271	417	LRMS,HRMS			

(Continued)

Table 349 (Continued)

Material	Process	Coal Type	Compound	Mol wt		Method of Identification†	Concn,† g/g	Sample Description/ Source	Reference
				Parent	Pentafluoropropyl Derivative				
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	NA	C_3-aminochrysene/aminobenzanthracene	285	431	LRMS		Ft. Lewis pilot plant, heavy distillate*	131
			C_4-aminochrysene/aminobenzanthracene	299	387	LRMS			
			aminobenzo[ghi]fluoranthene aminocyclopentapyrene	241	387	LRMS			
			C_1-aminobenzo[ghi]fluoranthene/aminocyclopentapyrene	255	401	LRMS			
			C_2-aminobenzo[ghi]fluoranthene/aminocyclopentapyrene	269	415	LRMS			
			C_3-aminobenzo[ghi]fluoranthene/aminocyclopentapyrene	283	429	LRMS			
			C_4-aminobenzo[ghi]fluoranthene/aminocyclopentapyrene	297	443	LRMS			
			aminobenzopyrene/aminoperylene/aminobenzofluoranthene	267	413	LRMS,HRMS			
			C_1-aminobenzopyrene/aminoperylene/aminobenzofluoranthene	281	427	LRMS,HRMS			
			C_2-aminobenzopyrene/aminoperylene/aminobenzofluoranthene	295	441	LRMS			
			C_3-aminobenzopyrene/aminoperylene/aminobenzofluoranthene	309	455	LRMS			
			C_4-aminobenzopyrene/aminoperylene/aminobenzofluoranthene	323	469	LRMS			
			aminodibenzopyrene/aminodibenzofluoranthene	317	463	LRMS			
			C_1-aminodibenzopyrene/aminodibenzofluoranthene	331	477	LRMS			

(Continued)

Table 349 (Continued)

Material	Process	Coal Type	Compound	Mol wt Parent	Mol wt Pentafluoropropyl Derivative	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	NA	**Nitrogen Polycyclic aromatic compounds, Fraction A-3**				
			C_1-indole	131	NA	Ft. Lewis pilot plant, heavy distillate††	132
			C_2-quinoline	157	NA		
			C_2-indole	145	NA		
			C_3-indole	159	NA		
			C_2-diphenyl ether	198	NA		
			C_4-quinoline	185	NA		
			tetrahydrobenzoquinoline	183	NA		
			phenanthrene	178	NA		
			benzoquinoline	179	NA		
			benzoquinoline	179	NA		
			C_1-tetrahydrobenzoquinoline	197	NA		
			tetrahydrocarbazole/benzoquinoline	171/179	NA		
			C_1-tetrahydrobenzoquinoline	197	NA		
			carbazole	167	NA		
			C_1-benzoquinoline	193	NA		
			C_1-tetrahydrocarbazole	185	NA		
			C_1-benzoquinoline	193	NA		
			C_1-carbazole/C_1-benzoquinoline	181/193	NA		
			C_1-benzoquinoline/C_2-benzoquinoline	193/207	NA		
			C_1-carbazole	181	NA		
			C_1-benzoquinoline	193	NA		
			C_2-benzoquinoline	207	NA		
			C_2-carbazole	195	NA		
			C_2-benzoquinoline	207	NA		
			C_2-carbazole	195	NA		
			C_2-carbazole	195	NA		
			C_3-carbazole	209	NA		
			azafluoranthene	203	NA		
			azapyrene	203	NA		
			C_4-carbazole	223	NA		
			C_1-azapyrene/C_1-azafluoranthene/ C_5-carbazole	217/237	NA		
			C_2-azapyrene/C_2-azafluoranthene/	231	NA		
			tetrahydrobenzocarbazole	221	NA		
			naphthoquinoline	229	NA		
			benzocarbazole	217	NA		
			C_1-benzocarbazole	231	NA		

(Continued)

Table 349 (Continued)

Material	Process	Coal Type	Compound	Mol wt Parent	Mol wt Pentafluoropropyl Derivative	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	NA	Hydroxyl polycyclic aromatic hydrocarbons, Fraction A-4			Ft. Lewis pilot plant, heavy distillateff	132
			C_1-indanol	148	NA		
			hydroxybiphenyl	170	NA		
			C_2-indanol	162	NA		
			C_1-hydroxybiphenyl	184	NA		
			C_1-hydroxybiphenyl	184	NA		
			C_3-indanol	176	NA		
			C_2-hydroxybiphenyl	198	NA		
			hydroxybiphenyl	170	NA		
			hydroxybiphenyl	170	NA		
			C_4-indanol	190	NA		
			C_3-hydroxybiphenyl	212	NA		
			C_1-hydroxybiphenyl/C_5-indanol	184/204	NA		
			C_1-hydroxybiphenyl	184	NA		
			C_1-hydroxybiphenyl	184	NA		
			C_3-hydroxybiphenyl	212	NA		
			hydroxyfluorene	182	NA		
			C_2-hydroxybiphenyl	198	NA		
			hydroxyfluorene	182	NA		
			hydroxyfluorene	182	NA		
			C_2-hydroxybiphenyl	198	NA		
			hydroxyfluorene	182	NA		
			C_2-hydroxybiphenyl	198	NA		
			C_4-hydroxybiphenyl/C_1-hydroxyfluorene	226/196	NA		
			C_3-hydroxybiphenyl	212	NA		
			C_3-hydroxybiphenyl/C_1-hydroxyfluorene	212/196	NA		
			naphthylphenol	220	NA		
			C_4-hydroxybiphenyl/C_2-hydroxyfluorene	226/210	NA		
			C_1-naphthylphenol	234	NA		
			C_5-hydroxybiphenyl/C_3-hydroxyfluorene	240/224	NA		
			naphthylphenol	220	NA		
			naphthylphenol	220	NA		
			C_1-naphthylphenol	234	NA		

(Continued)

Table 349 (Continued)

Material	Process	Coal Type	Compound	Mol wt		Sample Description/Source	Reference
				Parent	Pentafluoropropyl Derivative		
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	NA	Polyaromatic sulfur heterocycles subfraction A-26			Ft. Lewis pilot plant, heavy distillate††	132
			fluorene	166	NA		
			C_1-fluorene	180	NA		
			tetrahydrodibenzothiophene	188	NA		
			dibenzothiophene	184	NA		
			phenanthrene	178	NA		
			anthracene	178	NA		
			C_1-dibenzothiophene	198	NA		
			C_2-dibenzothiophene	212	NA		
			fluoranthene	202	NA		
			C_3-dibenzothiophene	206	NA		
			phenanthro[4,5-bcd]thiophene	208	NA		
			pyrene	202	NA		
			C_1-phenantho[4,5-bcd]thiophene	222	NA		
			benzonaphthothiophene	234	NA		
			C_1-benzonaphthothiophene	248	NA		
			C_2-benzonaphthothiophene	262	NA		
			Secondary nitrogen polycyclic aromatic heterocycles fraction S-1				
			C_2-indole	145	NA		
			C_3-indole	159	NA		
			C_1-diphenyl ether	184	NA		
			C_4-indole	173	NA		
			C_2-diphenyl ether	198	NA		
			phenanthrene	178	NA		
			tetrahydrocarbazole	171	NA		
			C_3-diphenyl ether	212	NA		
			carbazole	167	NA		
			carbazole isomers	167	NA		
			C_1-carbazole	181	NA		
			C_2-carbazole	195	NA		
			C_3-carbazole	209	NA		
			C_4-carbazole	223	NA		
			C_5-carbazole	237	NA		
			benzocarbazole	217	NA		
			benzocarbazole	217	NA		
			C_1-benzocarbazole	231	NA		
			C_2-benzocarbazole	245	NA		

(Continued)

Table 349 (Continued)

Material	Process	Coal Type	Compound	Mol wt Parent	Mol wt Pentafluoropropyl Derivative	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	NA	Enriched amino polycyclic aromatic hydrocarbons fraction S-2			Ft. Lewis pilot plant, heavy distillate[¶¶]	132
			naphthylamine	143	NA		
			aminobiphenyl	169	NA		
			C_1-aminobiphenyl	183	NA		
			C_2-aminobiphenyl	197	NA		
			aminofluorene	181	NA		
			benzo[h]quinoline[§§]	179	NA		
			carbazole	167	NA		
			C_1-benzoquinoline	193	NA		
			aminophenanthrene/aminoanthracene	193	NA		
			C_2-benzoquinoline	207	NA		
			C_3-benzoquinoline/C_1-aminophenanthrene	221/207	NA		
			C_4-benzoquinoline	235	NA		
			tetrahydronaphthoquinoline	233	NA		
			aminopyrene/aminofluoranthene	217	NA		
			tetrahydronaphthoquinoline	233	NA		
			naphthoquinoline (possibly benz[c]acridine)[§§]	229	NA		
			C_1-aminopyrene/C_1-aminoflouranthene	231	NA		
			naphthoquinoline (possibly benz[c]acridine)[§§] benzanthrone	229	NA		
			C_1-benzanthrone	230	NA		
			phthalate ester	244	NA		
			Tertiary nitrogen polycyclic aromatic hetrocycles fraction S-2				
			C_2-quinoline	157	NA		
			C_3-quinoline	171	NA		
			C_4-quinoline/unidentified peaks	185/158/183	NA		
			C_5-quinoline	199	NA		
			tetrahydroquinoline	183	NA		
			acridine[§§]	179	NA		
			phenanthridine[§§]/benzo[f]quinoline[§§]	179	NA		
			C_1-tetrahydroquinoline	197	NA		
			C_1-benzoquinoline	193	NA		
			C_2-benzoquinoline/azafluoranthene	207/203	NA		
			C_3-benzoquinoline	221	NA		
			azapyrene	203	NA		
			C_1-azapyrene/C_1-azafluoranthene	217	NA		
			naphthoquinoline	229	NA		

(Continued)

Table 349 (Continued)

Material	Process	Coal Type	Peak Number	Molecular Weight	Formula	Concentration (parts per thousand)	Possible Compound Types	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	NA	8	168	$C_{12}H_{10}O$	0.28	Dibenzofuran	Wilsonville pilot plant, heavy SRC	147
			13	182	$C_{13}H_{10}O$	0.21	Methyldibenzofuran		
			14	182	$C_{13}H_{10}O$	0.28	Methyldibenzofuran		
			15	182	$C_{13}H_{10}O$	0.08	Methyldibenzofuran		
			22	196	$C_{14}H_{12}O$	0.29	Methylxanthene		
			23	184	$C_{12}H_8S$	2.12	Dibenzothiophene		
			28	198	$C_{13}H_{10}S$	0.27	Methyldibenzothiophene		
			29	198	$C_{13}H_{10}S$	0.32	Methyldibenzothiophene		
			31	198	$C_{13}H_{10}S$	0.88	Methyldibenzothiophene		
			33	198	$C_{13}H_{10}S$	1.14	Methyldibenzothiophene		
			39	212	$C_{14}H_{12}O$	0.17	Ethyldibenzothiophene		
			40	212	$C_{14}H_{12}S$	0.24	Ethyldibenzothiophene## or ethylnaphthothiophene##		
			41	212	$C_{14}H_{12}S$	0.28	Ethyldibenzothiophene## or ethylnaphthothiophene##		
			42	212	$C_{14}H_{12}S$	2.11	Ethyldibenzothiophene## or ethylnaphthothiophene##		
			43	206	$C_{14}H_{16}S$	0.58	Ethyldibenzothiophene## or ethylnaphthothiophene##		
			44	212	$C_{14}H_{12}S$	0.22	Ethyldibenzothiophene## or ethylnaphthothiophene##		
			52	205	$C_{15}H_{11}N$	0.32			
			53	208	$C_{16}H_{16}$	0.99	2-Phenyl-1,2,3,4-tetrahydronaphthalene		
			80	234	$C_{16}H_{10}S$	0.91	Benzol[b]naphtho(2,1-d)-thiophene		
			81	234	$C_{16}H_{10}S$	0.50	Benzonaphthothiophene		
			83	230	$C_{16}H_{10}S$	0.32	Benzonaphthothiophene		
			87	248	$C_{17}H_{12}S$	0.61	Methylnaphthobenzothiophene		
			91	248	$C_{14}H_{12}S$	0.43	Methylnaphthobenzothiophene		
			93	242	$C_{19}H_{14}S$	0.43	2-Methylbenz(a)anthracene		
			94	242	$C_{18}H_{14}S$	0.63	1-Methylbenz(a)anthracene		
			96	242	$C_{19}H_{14}S$	2.21	3-Methylchrysene		
			97	242	$C_{19}H_{14}S$	1.91	12-Methylbenz(a)anthracene		

(Continued)

Table 349 (Concluded)

Material	Process	Coal Type	Compound	Mol wt		Sample Description/Source	Reference
				Parent	Pentafluoropropyl Derivative		
Coal raw heavy distillates (heavy fuel oils)	NA	--	--	--	--	--	--
Hydro-treated heavy distillates (heavy fuel oils) and residua	NA	--	--	--	--	--	--

Explanatory Notes

*Compounds identified in amino polycyclic aromatic hydrocarbons (APAH) fraction from alumina-silicic acid column separation.

†GC/ECD = capillary gas chromatography/electron capture detector (retention data), GC/MS = capillary gas chromatography/mass spectrometry, LRMS = low-resolution mass spectrometry, HRMS = high-resolution mass spectrometry.

‡Concentration in μg/g of APAH in crude SRC-II heavy distillate. Average value of two determinations using an internal standard of 1-aminonaphthalene. APAH for which quantitative data are not presented are lower in concentration than 15 ug/g.

§Two isomers of aminonaphthalene were identified by retention data: (1) 1-aminonaphthalene, 42.9 μg/g; (2) 2-aminonaphthalene, 161.4 μg/g.

#Two isomers of aminobiphenyl were identified by retention data: (1) 3-aminobiphenyl, 141.5 μg/g; (2) 4-aminobiphenyl, 95.8 μg/g.

**Three different isomers detected: (1) 48.0 μg/g, (2) 58.0 μg/g, (3) 47.2 μg/g.

††Two different isomers detected: (1) 31.0 μg/g, (2) 18.0 μg/g.

‡‡Determined via alumina-silicic acid fractionation followed by GC-MS analysis.

§§Possible structures assigned by retention data comparisons with standard compounds.

##May also be dimethyl.

Table 350. Compound Class Analysis Obtained by Solvent Fractionation

Material	Process	Coal Type	Value		Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-I	Wyodak	n-hexane soluble (oils)[*,†]		Wilsonville pilot plant, heavy SRC	150
			compound-class fraction	(wt % in SRC)		
			Fraction 1 hydrocarbons	11.4		
			Fraction 2 nitrogen heterocycles	4.4		
			Fraction 3 hydroxyl aromatics	3.9		
			Fraction total (1+2+3)	19.7		
			Fraction 4 polyfunctional compounds	NA		
			Solvent derived fractions (wt % in SRC)	19.7		
			Toluene soluble n-hexane[*,†] insoluble (asphaltenes)			
			compound-class fraction	(wt % in SRC)		
			Fraction 1 hydrocarbons	0.3		
			Fraction 2 nitrogen heterocycles	16.1		
			Fraction 3 hydroxyl aromatics	23.2		
			Fraction total (1+2+3)	39.6		
			Fraction 4 polyfunctional compounds	NA		
			Solvent derived fractions (wt % in SRC)	39.6		
			Pyridine soluble-toluene[*,†] insoluble (preasphaltenes)			
			compound-class fraction	(wt % in SRC)		
			Fraction 1 hydrocarbons	NA		
			Fraction 2 nitrogen heterocycles	2.6		
			Fraction 3 hydroxyl aromatics	6.8		
			Fraction total (1+2+3)	9.4[§]		
			Fraction 4 polyfunctional compounds	31.3[‡]		
			Solvent derived fractions (wt % in SRC)	40.7		
			SRC F-45[*,†]			
			compound-class fraction	(wt % in SRC)		
			Fraction 1 hydrocarbons	10.6		
			Fraction 2 nitrogen heterocycles	23.4		
			Fraction 3 hydroxyl aromatics	34.1		
			Fraction total (1+2+3)	68.1		
			Fraction 4 polyfunctional compounds	31.9		
			Solvent derived fractions (wt % in SRC)	100.0		

(Continued)

Table 350 (Concluded)

Material	Process	Coal Type	Value	Sample Description/Source	Reference
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--
Hydro-treated heavy distillates (heavy fuel oils) and residua	NA	--	--	--	--

Explanatory Notes

[*] Determined via solvent extraction procedure and gas chromatography.

[†] Determined via chromatographic separation procedure using switching column technique.

[‡] Determined via chromatographic separation procedure using dual column system.

[§] Chloroform soluble-toluene insoluble portion of preasphaltene.

[#] Determined by difference to 100%.

Table 351. General Physical and Chemical Properties of Various Distillation Fractions of Raw and Hydrotreated Heavy Distillates and Residua

Material	Process	Coal Type	Cut No.	Vapor Temperature, °F			Specific Gravity (60°F/60°F)	Pour Point, °F	Molecular Weight (cryoscopic)	Sample Description/Source	Reference
				5% Wt off	50% wt off	95% wt off					
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	Powhattan No. 5	12	690.8	710.6	739.4	1.0793	64.4	NA	PDU P-99, heavy distillate	110
			13	732.2	748.4	771.8	1.0918	84.2	NA		
			14	404.6	570.2	710.6	1.0184	15.8	NA		
			15	629.6	696.2	809.6	1.0773	69.8	NA		
			16	694.4	757.4	843.8	1.0973	84.2	NA		
			16HC*	712.4†	728.6	744.8†	1.0910	NA	NA		
			17	743	820.4	905	1.1195	100.4	NA		
			17HC*	789.8†	798.8	809.6†	1.1204	NA	NA		
			18	815	890.6	1000.4	1.1733	150.8	NA	PDU P-99, residuum	110
			19	892.4	969.8	1074.2	1.1950	210.2	NA		
			19HC-A*	919.4†	942.8	964.4†	1.1792	NA	NA		
			19HC-B*	964.4†	982.4	1000.4†	1.1971	NA	NA		
			450/650	444.2†	527	649.4†	0.9951	NA	NA		
			650/900	653	757.4	957.2	1.09	NA	NA		

(Continued)

Table 351 (Concluded)

Material	Process	Coal Type	API Gravity	Specific Gravity	Viscosity (cSt)	Molecular Weight	Pour Point, (°F)	Distillation (% Evaporation)	Flash Point, °F	Research Octane No.	Bromine Index	Gum Content (mg/100 ml)	Sample Description/Source	Reference
Hydrotreated heavy distillates (heavy fuel oils) and residue	EDS	IL No. 6	25.0	0.9042	2.37 (100°F)	220	<-75	367/398°F-IBP/5‡ 412/429°F/10/20 443/456°F-30/40 470/486°F-50/60 502/520°F-70/80 545/565°F-90/95 592°F-EP	136	NA	NA	NA	IBP to 600°F cut from first-stage hydrocracking of UOP raw 400°F+ heavy distillate Sample No. 3532-4 (UOP Sample No. 3532-7)	99
			17.3	0.9509	28.2 (100°F)	299	75	532/633°F-IBP/5§ 649/656°F/10/20 660/667°F-30/40 673/683°F-50/60 715/744°F-70/80 789/828°F-90/95 880°F-EP	NA	NA	NA	NA	600°F+ cut from first stage hydrocracking of UOP raw 400°F+ heavy distillate Sample No. 3532-4 (UOP Sample No. 3532-8)	99
			53.6	0.7645	NA	NA	NA	161/187°F-IBP/5 200/222°F/10/20 244/270°F-30/40 302/341°F-50/60 385/432°F-70/80 504/540°F-90/95 560°F-EP	NA	72.6	92	16	IBP to 375°F cut from second-stage hydrocracking of UOP Sample No. 3532-8 (UOP Sample No. 3532-17)	99
			27.4	0.8905	2.28	NA	NA	397/408°F-IBP/5‡ 416/423°F/10/20 430/439°F-30/40 450/464°F-50/60 486/512°F-70/80 539/560°F-90/95 585°F-EP	NA	NA	NA	NA	375°F+ cut from second stage hydrocracking of UOP Sample No. 3532-8 (UOP Sample No. 3532-17)	99
			53.5	0.7649	NA	NA	NA	164/184°F-IBP/5‡ 196/215°F/10/20 234/256°F-30/40 282/317°F-50/60 360/407°F-70/80 474/514°F-90/95 540°F-EP	NA	74.4	57	10	IBP-375°F cut from second stage hydrocracking of Sample No. 3432-8 (UOP Sample No. 3532-18)	99
			27.9	0.8877	2.06	NA	NA	400/404°F-IBP/5‡ 406/411°F/10/20 419/423°F-30/40 433/448°F-50/60 464/503°F-70/80 540/563°F-90/95 583°F-EP	NA	NA	NA	NA	375°F+ cut from second stage hydrocracking of UOP Sample No. 3532-8 (UOP Sample No. 3532-18)	99

Explanatory Notes

*Heart cut from secondary fractionation
†Full boiling range
‡Determined via ASTM D-86
§Determined via ASTM D-1160

Table 352. Elemental Composition Data of Various Distillate Fractions of Heavy Distillates and Residua

				Value							
				50% wt % Off Temperature °F	Elemental Composition, wt %, (Dry Basis)						
Material	Process	Coal Type	Cut No.		C	H	N	O	S	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	SRC-II	Powhattan No. 5	12	710.6	89.08	7.68	1.13	1.87	0.24	PDU P-99, heavy distillate	110
			13	748.4	90.38	7.70	1.28	0.27	0.37		
			14	570.2	88.12	8.37	0.90	2.29	0.32		
			15	696.2	88.66	7.66	1.31	1.90	0.47		
			16	757.4	89.10	7.34	1.39	1.81	0.36		
			17	820.4	88.70	7.27	1.56	2.03	0.44		
		Powhattan No. 5	18	890.6	88.63	7.02	1.75	1.99	0.61	PDU P-99, residuum	110
			19	969.8	89.31	6.32	1.82	1.98	0.57		
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--	--	--	--	--	--	--
Hydro-treated heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	NA	NA	87.80	12.03	0.00006	0.0718	0.0002	IBP to 600°F cut from first-stage hydrotreating of UOP raw 400°F heavy distillate Sample No. 3532-4 (UOP Sample No. 3532-7)	99
		IL No. 6	NA	NA	88.61	11.70	0.00083	0.0900	0.0030	600°F⁺ cut from first-stage hydrocracking of UOP raw 400°F⁺ heavy distillate Sample No. 3532-4 (UOP Sample No. 3532-8)	99
		IL No. 6	NA	NA	86.03	13.39	0.00002	0.0226	0.0365	IBP to 375°F cut from second-stage hydrotreating of UOP raw 400°F⁺ heavy distillate Sample No. 3532-8 (UOP Sample No. 3532-17)	99
		IL No. 6	NA	NA	86.93	12.17	0.00006	0.0723	0.0084	375°F⁺ cut from second-stage hydrocracking of UOP Sample No. 3532-8 (UOP Sample No. 3532-17)	99
		IL No. 6	NA	NA	86.72	13.34	0.00002	0.0197	0.0261	IBP to 375°F cut from second-stage hydrocracking of UOP Sample No. 3532-8 (UOP Sample No. 3532-18)	99
		IL No. 6	NA	NA	87.93	12.20	0.00002	0.0415	0.0137	375°F⁺ cut from second-stage hydrocracking of UOP Sample No. 3532-8 (UOP Sample No. 3532-18)	99

Table 353. Hydrocarbon Class Properties (Aromatics and Saturates Content) of Various Distillate Fractions of Heavy Distillates and Residua

			Value (vol %)			
Material	Process	Coal Type	Aromatics	Saturates	Sample Description/Source	Reference
Coal raw heavy distillates (heavy fuel oils) and residua	NA	--	--	--	--	--
Coal raw heavy distillate blends (heavy fuel oils)	NA	--	--	--	--	--
Hydrotreated heavy distillates (heavy fuel oils) and residua	EDS	IL No. 6	59.2	40.8	600°F$^+$ cut from first-stage hydrocracking of UOP raw 400°F$^+$ heavy distillate Sample No. 3532-4 (UOP Sample No. 3532-8)	99
		IL No. 6	9.9	90.1	IBP to 375°F cut from second-stage hydrocracking of UOP Sample No. 3532-8 (UOP Sample No. 3532-17)	99
		IL No. 6	11.6	88.4	IBP-375°F cut from second-stage hydrocracking of UOP Sample No. 3532-8 (UOP Sample No. 3532-18)	99

Table 354. General Physical and Chemical Properties of Secondary Coal-Derived Heavy Distillates

				Value					
Material	**Process**	**Coal Type**	**Parameter**	**Period 1***	**Period 2***	**Period 3***	**Period 4***	**Sample Description/Source**	**Reference**
Heavy distillate from hydro-treated whole coal liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Black-ville No. 2 Mine)	Gravity, °API	26.4	20.7	17.2	26.0	Ft. Lewis pilot plant; 550°F+ product from hydrotreating of SRC-II whole coal liquid with ICR 106 catalyst; Run No. 76-165. Operating conditions: Period 1, Run Hours 251-275, 750°F catalyst temperature 0.55 LHSV, 2300 psia H_2; Period 2, Run Hours 539-563, 750°F catalyst temperature, 1.51 LHSV, 2300 psia H_2; Period 3, Run Hours 2339-2351, 768°F catalyst temperture, 1.52 LHSV, 2300 psia H_2; Period 4, Run Hours 2709-2733, 776°F catalyst temperature, 0.49 LHSV, 2300 psia H_2.	86
			Aniline Point, °F	156.0	115.5	71.0	146.5		
			TBP Distillation, °F (simulated by chromatography)						
			St/5	398/534	378/528	427/539	346/518		
			10/30	550/582	547/588	551/586	541/579		
			50	604	616	608	602		
			70/90	625/655	648/685	630/658	624/653		
			95/99	668/694	700/722	669/691	664/681		
			Viscosity						
			cSt at 100°F	6.93	8.41	>.339	6.29		
			cSt at 210°F	1.99	2.14	NA	1.60		
			Density at 70°C	0.8619	0.8934	NA	0.8627		
			Molecular Weight	237	228	NA	238		
			Refractive Index at 80°F	1.4625	1.4872	NA	1.4659		

Explanatory Note

*Each period refers to a run time having a characteristic set of operating conditions.

Table 355. Elemental Composition of Secondary Coal-Derived Heavy Distillates

Material	Process	Coal Type	Parameter	Value (wt %)				Sample Description/Source	Reference
				Period 1*	Period 2*	Period 3*	Period 4*		
Heavy distillate from hydrotreated whole coal liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seam WV (Blackville No. 2 Mine)	Nitrogen	NA	0.0035	0.0068	NA	Ft. Lewis pilot plant; 550°F$^+$ product from hydrotreating of SRC-II whole coal liquid with ICR 106 catalyst; Run No. 76-165. Operating conditions: Period 1, Run Hours 251-275, 750°F catalyst temperature 0.55 LHSV, 2300 psia H_2; Period 2, Run Hours 539-563, 750°F catalyst temperature, 1.51 LHSV, 2300 psia H_2; Period 3, Run Hours 2339-2351, 768°F catalyst temperature, 1.52 LHSV, 2300 psia H_2; Period 4, Run Hours 2709-2733, 776°F catalyst temperature, 0.49 LHSV, 2300 psia H_2.	86
			Oxygen	NA	0.1600	NA	NA		

Explanatory Note

*Each period refers to a run time having a characteristic set of operating conditions.

Table 356. Hydrocarbon Class Properties (Saturates and Aromatics Contents) of Secondary Coal-Derived Heavy Distillates

				Value					
Material	**Process**	**Coal Type**	**Parameter**	**Period 1***	**Period 2***	**Period 3***	**Period 4***	**Sample Description/Source**	**Reference**
Heavy distillate from hydro-treated whole coal liquids	SRC-II	KY No. 9 and 14, IL No. 6 (River King Mine) and Pitt-Seams WV (Blackville No. 2 Mine)	Saturates	93.9	70.3	53.7	87.6	Ft. Lewis pilot plant; 550°F$^+$ product from hydrotreating of SRC-II whole coal liquid with ICR 106 catalyst; Run No. 76-165. Operating conditions: Period 1, Run Hours 251-275, 750°F catalyst temperature 0.55 LHSV, 2300 psia H_2; Period 2, Run Hours 539-563, 750°F catalyst temperature, 1.51 LHSV, 2300 psia H_2; Period 3, Run Hours 2339-2351, 768°F catalyst temperature, 1.52 LHSV, 2300 psia H_2; Period 4, Run Hours 2709-2733, 776°F catalyst temperature, 0.49 LHSV, 2300 psia H_2.	86
			Aromatics	6.0	29.7	46.4	12.4		

General Comments

1. Benzo(a)pyrene and 2-aminoanthracene have been detected in SRC-II heavy distillate, with mutagenic activities of 114 and 4,326 revertants/μg, respectively (Reference 133).

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